Engineering Library

OCT 27

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VOL. CXLII.—No. 3692] LONDON: FRIDAY EVENING, OCTOBER 15, 1926 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

The Director - General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for—

500 AXLE-BOXES for Carriages and Wagons.

Tenders due on the 26th October, 1926.

Specifications and forms of Tender obtainable from the above at a fee of 5s. per set, which will not be returned. 3787

Ministry of Transport.
ARTERIAL ROADS — GREATER LONDON.
NORTH CIRCULAR ROAD—WALTHAMSTOW AND WOODFORD.

The Minister is prepared to receive TENDERS for CONSTRUCTION and SURFACING WORK in connection with sections of the North Circular Arterial Road, Walthamstow and Woodford, Essex.

Forms of Tender, conditions of Tender, conditions of contract, bill of quantities and specification may be obtained from the Chief Engineer, Roads Department, Ministry of Transport, 7, Whitehall-gardens, S.W. 1, upon payment of a deposit of £25.

This amount will be returned to the tenderer if his Tender is a bona fide one and has not been withdrawn prior to the definite acceptance of a Tender by the Minister.

The drawings may be inspected at the offices of the Ministry and copies of the Tender documents will be available on and after Wednesday, 27th October, 1926.

Tenders, on the official forms, accompanied by a fully priced bill of quantities and schedules of prices and enclosed in a sealed envelope, endorsed "Tender for Construction and Surfacing, North Circular Road, Essex," must reach the Assistant Secretary, Roads Department, Ministry of Transport, 7, Whitehall-gardens, S.W. 1, by 10 a.m. on Wednesday, the 10th November, 1926.

The Minister does not bind himself to accept the lowest or any Tender.

Dated this 5th day of October, 1926.

E. W. ROWNTREE,
Assistant Secretary.

Ministry of Transport. 3724

Ministry of Transport.
ARTERIAL ROADS, GREATER LONDON.
BEXLEY HEATH BY-PASS, KENT.

The Minister is prepared to receive TENDERS for CONSTRUCTION WORK in connection with the Bexley Heath By-pass Arterial Road, Kent.

Forms of Tender, conditions of Tender, conditions of contract, bill of quantities and specification may be obtained from the Chief Engineer, Roads Department, Ministry of Transport, 7, Whitehall-gardens, S.W. 1, upon payment of a deposit of £25.

This amount will be returned to the tenderer if his Tender is a bona fide one, and has not been withdrawn prior to the definite acceptance of a Tender by the Minister.

The drawings may be inspected at the offices of the Ministry, and copies of the Tender documents will be available on and after Friday, 22nd, October, 1926.

Tenders on the official form, accompanied by a fully priced bill of quantities and schedules of prices, and enclosed in a sealed envelope, endorsed "Tender for Construction, Bexley Heath By-pass," must reach the undersigned by 10 a.m. on Friday, the 5th November, 1926.

The Minister does not bind himself to accept the lowest or any Tender.

Dated this 8th day of October, 1926.

H. H. PIGGOTT,
Assistant Secretary.

Ministry of Transport. 3738

Ministry of Transport.
ARTERIAL ROADS, GREATER LONDON.
WOODFORD - ILFORD ROAD, ESSEX.

The Minister is prepared to receive TENDERS for SURFACING, KERBING WORK, &c., in connection with a section of the Woodford-Ilford Arterial Road, Essex.

Forms of Tender, conditions of Tender, conditions of contract, bill of quantities and specification may be obtained from the Chief Engineer, Roads Department, Ministry of Transport, 7, Whitehall-gardens, S.W. 1, upon payment of a deposit of £25.

This amount will be returned to the tenderer if his Tender is a bona fide one and has not been withdrawn prior to the definite acceptance of a Tender by the Minister.

The drawings may be inspected at the offices of the Ministry, and copies of the Tender documents will be available on and after Friday, 29th October, 1926.

Tenders on the official form, accompanied by a fully priced bill of quantities and schedule of prices, and enclosed in a sealed envelope, endorsed "Tender for Surfacing, Kerbing, &c., Woodford-Ilford Road," must reach the undersigned by 10 a.m. on Friday, the 12th November, 1926.

The Minister does not bind himself to accept the lowest or any Tender.

Dated this 8th day of October, 1926.

H. H. PIGGOTT,
Assistant Secretary.

Ministry of Transport. 3739

Civil Engineers (5) Re-QUIRED for the PUBLIC WORKS DEPARTMENT of TANGANYIKA TERRITORY for a tour of 20 to 30 months' service, with possible extension. Salary £480, rising by annual increments to £720 a year (with efficiency bar at £600), payable in the Territory in local currency. Outfit allowance of £30 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, aged 25 to 35, preferably unmarried, must have been regularly trained as civil engineers and be Corporate Members of the Institution of Civil Engineers. Must be capable of levelling, surveying, measuring up work and preparing designs of bridges, &c. Must have had at least three years' experience under a qualified civil engineer on the construction of harbour works, drainage works, water supply, or other public works.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/14402. 3761

University of London.

A COURSE of EIGHT LECTURES on "THE INTERACTION OF PURE SCIENTIFIC RESEARCH AND ELECTRICAL ENGINEERING PRACTICE" will be given by Professor J. A. FLEMING, F.R.S. (Emeritus Professor of Electrical Engineering in the University of London), at the INSTITUTION OF ELECTRICAL ENGINEERS (by kind permission), SAVOY-PLACE, VICTORIA EMBANKMENT, W.C. 2, on WEDNESDAYS and FRIDAYS, OCTOBER 20, 22, 27, and 29, and NOVEMBER 10, 12, 17, and 19, 1926, at 5.30 p.m. The Chair at the First Lecture will be taken by Prof. E. H. Lamb, D.S.C., M.Sc. (Dean of the Faculty of Engineering), and at the last Lecture by Lieut-Colonel A. J. O'Meara, R.E., C.M.G., M.I.E.E. (Chairman of the Board of Studies in Electrical Engineering). The Lectures will be illustrated with lantern slides. A detailed syllabus may be obtained on application to the undersigned.

ADMISSION FREE, WITHOUT TICKET.

EDWIN DELLER,
Academic Registrar.

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The Engineer

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PUBLIC NOTICES

Assistant Engineers (10) REQUIRED by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT for two tours of not less than 12 nor more than 18 months' service in the first instance. Subject to satisfactory service, the officers appointed will be eligible at the expiration of three years' service for confirmation in the permanent and pensionable establishment. Salary £480, rising to £920 a year. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, preferably between 25 and 30 years of age, unmarried, must have passed the examination for A.M.I.C.E. or possess a degree in civil engineering recognised by the Institution as exempting from Parts "A" and "B" of the examination. They must have had proper technical training and preferably have had not less than two years' subsequent experience on large engineering or municipal works. Candidates possessing other civil engineering qualifications may apply.—Applications should be made at once by letter, stating age, qualifications and experience, also whether married or single, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, London, S.W. 1, quoting M/14485. 3763

Assistant Engineers Re-QUIRED by the RAILWAY DEPARTMENT of the FEDERATED MALAY STATES GOVERNMENT for four years' service, with possible extension. Salary 400 dollars, rising to 475 dollars a month by annual increments of 25 dollars a month, and thereafter, in the event of the officer being retained, rising to 800 dollars a month, plus a temporary non-pensionable allowance of 10 per cent. for bachelors and 20 per cent. for married men. The exchange value of the dollar in sterling is at present fixed by the Government at 2s. 4d., but the purchasing power of the dollar in Malaya is considerably less than that of 2s. 4d. in the United Kingdom. No income tax is at present imposed by the Federated Malay States Government. Free passages provided. Candidates, age 23 to 30, preferably unmarried, must have received a good theoretical training, preferably at a University or a College recognised by the Institution of Civil Engineers and possess a civil engineering degree, or obtained such other diploma or distinction in engineering as the Secretary of State may decide in any particular case, or completed their articles with a civil engineer of good standing, and have passed the examination for Associate Membership of the Institution of Civil Engineers. Should have had at least one year's practical experience of railway maintenance on a British railway.—Apply at once by letter, giving brief details of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting clearly at head of application M/13963. 3762

PUBLIC NOTICES

INDIAN RAILWAY SERVICE OF ENGINEERS.

The Secretary of State for INDIA IN COUNCIL will in the near future make FOUR APPOINTMENTS as ASSISTANT EXECUTIVE ENGINEERS in this service. Every candidate must be a European British subject of non-Asiatic domicile, and must be not less than 21 and not more than 25 years of age on 1st January, 1927. He must either (1) have obtained one of certain recognised University Degrees or other distinctions in Engineering, or (2) have passed Sections A and B of the Associate Membership Examination of the Institution of Civil Engineers or been exempted by the Institution from such examination, or (3) produce evidence that he is otherwise eligible under the Regulations. He must, in addition, have had at least one full year's practical experience of Civil Engineering under a qualified civil engineer at the time when he appears before the Selection Committee.

Applications from candidates must reach the India Office not later than 30th November, 1926. Printed forms, together with information regarding the conditions of appointment may now be obtained from the SECRETARY, Services and General Department, India Office, Whitehall, London, S.W. 1. 3745

The High Commissioner for INDIA is prepared to receive APPLICATIONS for APPOINTMENTS as CIVIL ENGINEERS for temporary service on Indian State Railways. Three years' agreement. Consolidated pay of Rs. 800-50-1000 per mensem for officers of non-Asiatic domicile and Rs. 800-50-800 per mensem for officers of Asiatic domicile. Initial pay according to age and qualifications.

Candidates must be British subjects, and ordinarily not more than 35 years of age. They must have either (1) obtained a recognised University Degree or other distinction in Civil Engineering, or (2) be Chartered Civil Engineers, or (3) possess such other diploma or distinction in Civil Engineering as may be considered acceptable. In addition, they should possess at least three or four years' practical experience, preferably on railways or in railway works.

Information regarding the conditions of appointment and forms of application may be obtained from the SECRETARY to the High Commissioner for India, 42, Grosvenor-gardens, London, S.W. 1. Last date for receipt of applications, 30th November, 1926. 3786

SITUATIONS OPEN

ADVERTISER, Box P2244, in THE ENGINEER, Sep. 17th last, much obliged for answers received. VACANCY has now been FILLED; original testimonials will be returned. P2366 A

PUBLIC NOTICES

FOR SALE.

At R.A.F. Station, WEST DRAYTON, MIDDLESEX.

GENERATING STATION PLANT.

ONE AUSTIN GENERATING SET, 10 K.W. Engine, Austin, 2-cylinder, petrol, direct coupled to generator, D.C., 240 volts, 40 amps., compound wound with shunt regulator and mounted on cast iron bed-plate.

ONE ROBEY GENERATING SET, 20 K.W. Engine, Robey, single-cylinder, vertical semi-Diesel, 35 B.H.P., direct coupled to generator, D.C., 230-240 volts, 91/83 amps., shunt wound by E.C.C., with shunt regulator and mounted on cast iron bed-plate, complete with starting bottle.

ONE CAMPBELL GENERATING SET, 10 K.W. Engine, Campbell, single-cylinder, semi-Diesel, C.A. starting, direct coupled to generator, D.C., 220-240 volts, 45 amps., 450 r.p.m., shunt wound, with shunt regulator (Messrs. Electromotors, Ltd.), complete with starting bottle.

ONE SWITCHBOARD, comprising 3 C.C. wattmeters, 220 volts; 6 D.P. switches; 3 circuit breakers; fuse holders; 2 voltmeters 0/250 and 10 ammeters; complete with 5 water cooling tanks, chequer plating, cables, cable clips, and spare parts for engines and dynamos.

ELECTRICAL MOTORS of various makes from ½ to 7 H.P.; Motor Generator, 1 H.P., with switchboard and starter; one drum cable, containing 296ft. 19/.065 cable PILCDSTA. Sundry small Electrical Stores.

Applications for forms of Tender should be addressed to—

THE SUPERINTENDING ENGINEER,
N.W. District,
W. and B. Department,
R.A.F. DEPOT.
Uxbridge, Middlesex.

and should arrive not later than 30th October, 1926. 3738

Form P. Amendt. 2.
PATENTS AND DESIGNS ACTS, 1907 AND 1919.

Notice is Hereby Given that HATHORN, DAVEY and CO., Ltd., a company organised under the laws of Great Britain, and HUGH RALPH LUPTON, a British subject, both of Sun Foundry, Dewsbury-road, Leeds, in the County of York, SEEK LEAVE to AMEND the SPECIFICATION of APPLICATION for LETTERS PATENT No. 257,111, for an invention, entitled "Improvements in or relating to Centrifugal Pumps."

Particulars of the proposed amendment were set forth in the Illustrated Official Journal (Patents) of the 6th October, 1926.

Any person, or persons, may give Notice of Opposition to the Amendment by leaving Patents Form No. 19 at the Patent Office, 25, Southampton-buildings, London, W.C. 2, within one calendar month from the date of the said Journal.

W. S. JARRATT,
Comptroller-General.

3734

Institution of Structural ENGINEERS.
EXAMINATIONS FOR GRADUATESHIP AND ASSOCIATE-MEMBERSHIP.

The next EXAMINATIONS will be held on DECEMBER 1st (Graduateship) and DECEMBER 2nd-3rd (Associate-Membership); closing date for entry November 22nd.

Centres have been arranged in London, Manchester, Norwich, Johannesburg, Madras, Bombay, and Wellington, New Zealand. Further centres may be arranged according to the candidates forthcoming.

Syllabus and full particulars from the undersigned.

MAURICE G. KIDDY, F.I.S.A.,
Secretary.

10, Upper Belgrave-street, S.W. 1. 3769

Institution of Structural ENGINEERS.
MODIFIED EXAMINATION FOR ASSOCIATE-MEMBERSHIP.

This Examination is held quarterly for candidates of and over 25 years of age, having 10 years' practical experience, including time served in articles. It consists of a problem in design with a little additional work, which is carried out by the candidate at his own home. The NEXT EXAMINATION will be held on NOVEMBER 20th, and entries should reach me before November 15th. Syllabus and full particulars from the undersigned.

MAURICE G. KIDDY, F.I.S.A.,
Secretary.

10, Upper Belgrave-street, S.W. 1. 3770

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PUBLIC NOTICES

Derbyshire Education Committee.

CHESTERFIELD TECHNICAL COLLEGE.

Principal: W. R. PARSONAGE, B.Sc., M.I. Mech. E.

A full-time LECTURER in ELECTRICAL ENGINEERING is REQUIRED. Salary in accordance with the Burnham Scale. Further particulars and a form of application, which should be returned by October 30th, can be obtained from the undersigned.

P. G. FEEK,
Director of Education.

County Education Offices,
S. Mary's Gate, Derby. 3764

City and County of Bristol—

GUARDIANS OF THE POOR.
BOILER AND LAUNDRY PLANT.

The Guardians invite TENDERS for the SUPPLY and ERECTION of BOILER and LAUNDRY PLANT at their Institution at Eastville, described in the drawings and specification prepared by their Consulting Engineer, Mr. E. S. Hoare, B.Sc., A.M.I.C.E.

The specification is in two parts:—
No. 1.—Boilers, Steam Piping, &c.;
No. 2.—Laundry Equipment, Piping, &c.;
and contractors may Tender for either or both of the above.

Particulars and copies of specification may be obtained on application to the undermentioned after payment of a deposit of £5 5s., which deposit will be returned to each person making a bona fide Tender in accordance with the terms of this advertisement and the contract.

Tenders must be forwarded to reach me not later than 10 a.m. on Wednesday, the 3rd November, 1926. The Guardians do not bind themselves to accept the lowest or any Tender, but in the event of their proposing to accept a Tender they reserve to themselves the right to require the person or persons making such Tender to furnish such security as they may think necessary for the due execution of the contract.

By Order,
THOS. S. LAMB,
Clerk to the Guardians.

St. Peter's Hospital, Bristol,
October, 1926. 3782

Great Southern Railways.

The Directors of the Great Southern Railways, Ireland, are prepared to receive TENDERS for the SUPPLY of the following MATERIAL:—

2000 Tons No. 90 R. Bull-head Rails (British Standard Section).
60 Tons Fish-plates for Ditto.
6500 Tons 85 lb. F.B. Rails (G.S.R. Section).
160 Tons Fish-plates for Ditto.
1200 Tons Cast Iron Chairs (50 lb.).
2700 Tons Cast Iron Soleplates (22 lb.).
150 Tons Fang Bolts.
800 Tons Sleeper Bolts.
100 Tons Fishbolts.
75,000 Teak Keys.

Specifications, forms of Tender (on which alone offers will be considered), and drawings can be obtained on application to the Company's Stores Superintendent, Inchicore, Dublin, on payment of Two Shillings and Sixpence for each Tender form.

Tenders should be forwarded so as to reach the undersigned not later than 10 a.m. on Monday, 1st November, in the envelope provided for the purpose.

The Directors do not bind themselves to accept the lowest or any Tender.

C. E. RILEY,
Secretary.

Kingsbridge Station, Dublin. 3776

State Electricity Commission

OF VICTORIA,
MELBOURNE, VICTORIA, AUSTRALIA.

TENDERS are hereby INVITED for the SUPPLY, DELIVERY, &c., of the following for the Yallourn Power Scheme.

Copies of Tender form and specification will be available upon application to:—
Agent-General for Victoria,
Victoria House, Melbourne-place,
Strand, London, W.C. 2.

SPECIFICATION NO. 26.—82 H.P. WATER-TUBE BOILER, WITH SUPERHEATER, ECONOMISER AND ACCESSORIES.

CHARGE.—£3 3s. for the first three copies of Tender form, conditions of contract, and specification complete.

This charge will be returned in the event of a bona fide Tender being received. A fourth copy and any further copies will be supplied for the sum of £1 1s. each. This charge is not returnable.

PRELIMINARY DEPOSIT.—A preliminary deposit of 1 per cent. of Tender price is to be lodged with Tender, but in no case shall this amount exceed £100.

The specifications may be inspected at the above-mentioned office.

The Commission does not bind itself to accept the lowest or any Tender.

Tenders, on prescribed form, properly endorsed and addressed, must be delivered to the undersigned in Melbourne not later than 5 p.m., 15th December, 1926.

R. LIDDELOW,
3665 Secretary.

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, EXPERT ENGINEER as ADVISER and CONSULTANT by INDIAN CONTRACTORS executing a contract involving construction three tunnels in trap rock, and about two miles realignment of main line track; only those having similar experience in supervisory position need apply; must accustomed organisation, complete removal and quick disposal large masses material; salary, Rupees 1500 per month; free furnished quarters, passage out and home; good climate and healthy station.—Write, Box Z.C. 839, c/o Deacon's Advertising Offices, Fenchurch-avenue, London, E.C. 3. 3760 A

A LARGE GENERAL ENGINEERING COMPANY REQUIRE the SERVICES of an ENGINEER with negotiating and commercial experience, to understudy London Manager who is shortly retiring.—Address, 3755, The Engineer Office. 3755 A

PULVERISERS.
A WELL-KNOWN FIRM of ENGINEERS holding several PULVERISER PATENTS, REQUIRES the SERVICES of an EXPERT.—Write, stating qualifications and fees or salary required, to 3737, The Engineer Office. 3737 A

DREDGING MASTER and also ENGINEER, Experienced in Handling Large Bucket Dredgers, REQUIRED for Port, East Coast of Africa. Free second-class passage out and return on satisfactory termination of services. Pay at the rate of £50 per month for Dredging Master and £15 per month for Engineer.—Applications, with full particulars of experience, to be addressed to "B. O.," c/o J. W. Vickers and Co., Ltd., 24, Austin Friars, London, E.C. 2. 3768 A

ENERGETIC TECHNICAL MAN, with Up-to-date experience of Lead and Nickel-iron Battery practice, to Take Charge of Department engaged in manufacture and maintenance of Train Lighting Cells. Age about 25 to 35. Salary about £300, according to experience.

Address, stating age, qualifications, past experience, and positions held, 3759, The Engineer Office. 3759 A

ENGINEER WANTED, with Knowledge and Experience of Grinding Plant, by TRADE PULVERISING COMPANY, handling coal and wide range of other materials. Bound investment £2000 to £5000, salaried post and/or directorship. Open to every investigation.—Apply, ARTHUR J. HENDERSON, M.I.P.T., Consulting Engineer, Astor House, Aldwych, W.C. 2. 3766 A

SIEBE, GORMAN & CO.'S
DIVING APPARATUS.
Sole Makers to the British Admiralty.

SMOKE HELMETS,
OXYGEN BREATHING APPARATUS
for poisonous air.
MEDICAL OXYGEN APPARATUS
and
AIR COMPRESSORS & VACUUM PUMPS
Immediate Delivery.

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THIS TRADE HYSON *MARK ON*
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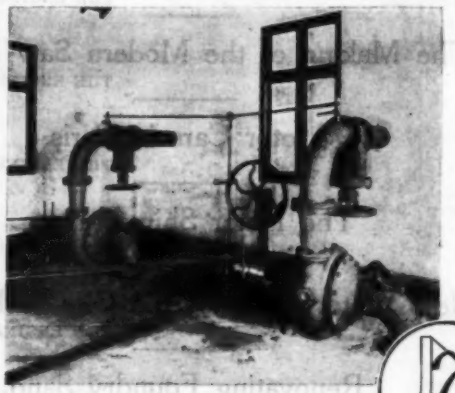

The "STEREOPHAGUS" PUMP

A FAMOUS NAME IN THE SEWAGE WORLD

From the entrance to the sewerage system to the discharge at the sewage works, none but "Stereophagus" pumps need be installed.

A "Stereophagus" pump requires no screens, and nothing that can pass through the suction pipe will be too much for it.

The impeller is adjustable, and thus full efficiency is always maintained.

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Write for List No. 1142.

The Pulsometer Engineering Company specialises in the design and manufacture of pumping and refrigerating machinery of all kinds. Suggestions as to the most suitable installations for your requirements will be sent on receipt of particulars.

Pulsometer Engineering Co. Ltd
NINE ELMS IRONWORKS · READING
London Offices: 11 TOTHILL STREET, S.W.1

SITUATIONS OPEN (continued)

ENGINEERING REPRESENTATIVE WANTED to join the staff of firm in India, specialising in Combustion and Boiler House Economics; applicant must be unmarried, and not over 35. Post offers big possibilities to the right man. Send full particulars.—Address, 3741, The Engineer Office. 3741 A

FOUNDRY MANAGER.—WANTED for India, a FOUNDRY MANAGER to Superintend an output of about 1500 tons weekly of Chairs, Sleepers, General Castings and Vertically Cast Pipes. A man of about 35 years of age preferred. Salary about £800 p.a., rising to £1000 p.a., with free unfurnished quarters and passage out and home. Five years' engagement, with intention renewal.—Applications, stating age and accompanied by particulars of experience, &c., to be addressed to "FOUNDRY," E.D. Advertisement Dept., 5, New Bridge-street, London, E.C. 4. 3731 A

IMPORTANT HIGH-GRADE STEEL WORKS (8000 workmen; annual output 60,000 tons special steels) REQUIRE

SEVERAL MECHANICAL ENGINEERS

(young, energetic), wide experience of trade in Tool and High-tensile Steels, to act as

REPRESENTATIVES

in all important steel-buying districts. Wages, expenses and commission. Successful applicants to work exclusively as our sole agents.

Apply by letter only to

BRITISH & "SAAR STEEL" CO., LD.,
58, VICTORIA-STREET, S.W. 1.

stating experience and sending testimonials. Only first-class men with knowledge of steel business need apply. F2380 A

REINFORCED CONCRETE DESIGNER, with Good specialist experience, REQUIRED.—Address, stating age, salary required, and full details of experience, 3785, The Engineer Office. 3785 A

REQUIRED IMMEDIATELY, ENGINEERS, with wide experience in the design and operation of Heavy Chemical Plant, working at extremely high pressures of 300 to 500 atmospheres. Applications, which will be treated in confidence, to give full particulars of candidate's experience, together with salary required.—Address, 3756, The Engineer Office. 3756 A

REQUIRED, EXPERT, with Sound Technical and general experience in Abrasive Materials, particularly Artificial Abrasive Wheels.—Write, with fullest particulars, salary required, &c.—Address, F2360, The Engineer Office. F2360 A

THE ADVERTISING DEPARTMENT of an ENGINEERING MANUFACTURING BUSINESS in the provinces REQUIRES CHIEF ASSISTANT, who must be thoroughly capable and able to write good, sound, and attractive matter.—Address, 3750, The Engineer Office. 3750 A

WANTED, MECHANICAL DRAUGHTSMAN; works experience essential. Cranes, Conveyors, Elevators, and Crushing Plant.—Particulars of experience, age, and salary to WORKS MANAGER, Bevan's Works, Northfleet. F2369 A

WANTED, TWO SENIOR DRAUGHTSMEN, with first-class experience in Automobile Chassis design, also experienced Jig and Tool Draughtsmen. Good salaries to right men. State age, experience, and salary required.—Address, 3684, The Engineer Office. 3684 A

DRAUGHTSMAN DESIGNER (Electro-mechanical) WANTED by Firm in London district. Only man with sound mechanical and electrical technical knowledge will be considered. Must also have had thorough practical experience. Good remuneration for really first-class man.—Address, stating experience and salary desired, 3697, The Engineer Office. All applications will be treated in strict confidence. 3697 A

DRAUGHTSMEN.—First-class CIVIL ENGINEERING DRAUGHTSMEN REQUIRED temporarily in Railway Engineer's Office in London; must be thoroughly experienced in all kinds of Structural Work and able to work with a minimum of supervision.—Address, stating age, experience, and salary required 3778, The Engineer Office. 3778 A

DRAUGHTSMAN REQUIRED for Birmingham District, with experience of Heating as applied for Drying purposes. Experience with Conveyor Plants an advantage.

Permanency and good prospects for right man. State full particulars of experience, age, and salary required, also when free for engagement.

Address, 3781, The Engineer Office. 3781 A

DRAUGHTSMAN, with First-class Experience of Steam Turbine design and detail work. State age, salary, experience, and when able to commence.—Address, 3696, The Engineer Office. 3696 A

EXPERIENCED MECHANICAL DRAUGHTSMAN REQUIRED for modern Iron and Steel Works. State age, experience and salary required.—Address, 3783, The Engineer Office. 3783 A

HEAD DRAUGHTSMAN, Experienced in Machine Tool design, REQUIRED by Engineers in the North.—Address, stating age, salary, experience as designer and supervisor, F2366, The Engineer Office. F2366 A

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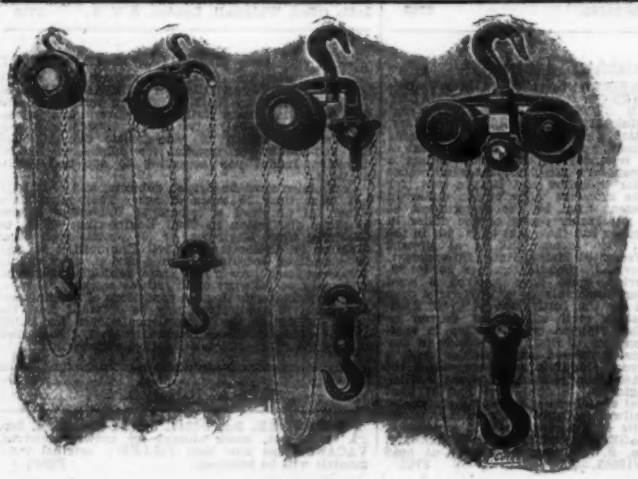
For continuation of Small Advertisements see page 3.



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Trades Union Law.

IN the course of the speech which he delivered before a mass meeting in connection with the Unionist Conference at Scarborough, on October 7th, Mr. Baldwin dealt with the burning question of the reform of Trades Union law. The Cabinet, he said, was fully alive to the importance of the question, and as soon as it had completed its examination of the subject, it would prepare a Bill and proceed with it in Parliament. Whilst he thought that the state of society still made collective bargaining necessary and that Trades Unions were, therefore, still needed, he held that the country was as great as the masters of industry or the Trades Unions. The task which had to be faced was to reconcile the rights of men in combination with the rights of individuals, and both of them in relation to the wider community of which they were only a part. This statement that the Government was taking action, and that it would bring in a Bill was in a sense a reply to a motion put before the National Union of Conservative and Unionist Associations by Sir Arnold Grindley. This motion urged the Government to introduce legislation, first, to make illegal any strike called without a secret ballot of the members of the Trade Union affected; secondly, to increase the security of the individual worker against victimisation and intimidation on account of his political belief; thirdly, to make mass picketing and the picketing of a private residence illegal; and fourthly, to require the national accounts of Trades Unions to be audited by certified accountants. Whether it will be possible to get these four comprehensive clauses carried into effect, there are, as yet, no means of saying, but there is strong evidence that the country is determined that mass picketing, at least, shall be prohibited, and it is convinced that the secret ballot would prevent the ripening of many strikes.

Electricity Supply.

In the course of the speech alluded to above, the Prime Minister referred to another subject in which engineers are deeply interested. He expressed a hope that the Electricity Bill would soon become law. It was believed that on account of the improvements in supply which would be effected under that Bill, saving in capital charges and the improvement in load factor would be so great that current could be supplied to authorised undertakings at less than half the average present cost, and at a lower price than that at which even the best installations can produce it to-day. He added that careful provision was made in the Bill that the benefit of cheap generation should be passed on to the consumer. The Government had been informed by its expert advisers that the saving in capital expenditure during the next few years after the Bill came into operation would be more than sufficient to pay for the whole cost of the transmission lines, and at the end of that period the annual saving in cost of generating would approximate to £11,000,000 a year. He recognised that since that amount would be spread over a vast multitude of consumers, individuals could only benefit to a small extent, but the result on the community as a whole would be very great, and he believed the reduction in cost would lead to a great extension of the use of electricity in industry and would render it possible to supply many rural districts which are now outside the present areas of supply.

Double-acting Oil Engines.

ON Tuesday last, October 12th, Mr. W. S. Burn read before the Institute of Marine Engineers an interesting paper on "Double-acting Oil Engines." In it he opened with the remark that one frequently heard engineers say that they preferred a reliable engine to an economical engine. Whilst pointing out that there might be a fallacy in that statement, he went on to show that fundamentally good running conditions could be obtained by the reduction of the indicated mean pressure or the fuel consumption, but the only method of obtaining the former without commercial sacrifice was to make use of the double-acting principle and preferably the two-stroke cycle. Mr. Burn holds that the two-stroke cycle adapts itself more readily to the double-acting principle than the four-stroke cycle, in which the most complicated part, namely, the cylinder covers with all the attendant valve gear, are duplicated. He affirmed that whilst firms engaged in the development of the double-acting two-stroke type were first attracted to it by its inherent low first cost, there seemed to be no doubt that it would ultimately bring "steam engine reliability" to the oil engine. He stated his belief that the double-acting two-stroke engine, even in its present state, was more immune from ordinary mechanical troubles than any other type. He admitted, however, with regard to cylinder conditions that they might be slightly inferior to those of the single-acting two-stroke engine in cylinders of given dimensions, but when it was remembered that, for a given power, the size of cylinders, the mean effective pressure and the fuel consumption could be reduced if the double-acting two-cycle were employed, then the cylinder conditions of that type were superior. He regarded the vogue for the use of supercharging in four-cycle engines as no more than a temporary expedient pending the arrival of the double-acting type. After this strong advocacy of the double-acting engine, Mr. Burn went on to discuss details.

Exhibition of Inventions.

THE second International Exhibition of Inventions, arranged by the Institute of Patentees, is a considerable improvement on its predecessor. It was opened in the Central Hall, Westminster, on the 13th inst., and will remain open until Saturday, the 23rd. On this occasion the exhibits have been divided into two distinct sections, those which have already achieved some degree of commercial development, and those which have not yet attained to the stage of manufacture. The former class, naturally, is the less interesting, and that part of the Exhibition savours more of a bazaar; but down in the basement, to which the new inventors have been banished, there are some really interesting exhibits. Many of them are of a domestic nature, and consequently only indirectly interesting to engineers, but we cannot complain of inventors turning their attention in that direction, as it is most often the more profitable, and the wrapt attention of the lady visitors gives support to this theory. There are, however, a number of purely mechanical devices on view, some of which suggest considerable promise in the future if developed properly. On the other hand, some of the exhibits make one wish that there were some committee which could discourage some inventors from following obviously impracticable ideas, and lead them to more useful purposes. The Exhibition is well worthy of a visit, if only for the purpose of imbibing some of the enthusiasm of the exhibitors.

The Open Shop.

REPORTS received within the last few days from the United States seem to indicate that American trades unionists are resolved to make a renewed attack upon the open shop. In Detroit, which is the home of the motor car trade, the open shop is the rule rather than the exception, and it is there that the highest wages are paid. It is because the men are paid so much that they appear to be indifferent about unions, and it will be very interesting to see if they can be persuaded to risk the prosperity of a great industry, with which their own prosperity is associated, at the dictates of labour leaders. The Unions are particularly incensed by Mr. Henry Ford's independence, and by the great development of repetition work which he has introduced, but they are forced to admit that in adopting the five days' week, Mr. Ford has met many of their objections to the high specialisation which his methods of manufacture require. The American Federation of Labour appears to be, however, under no illusions as to the immediate possibility of introducing the five days' week into the engineering industries as a whole. It refused to support a motion which called for the immediate introduction of the shorter week, but at the same time it strongly urged the progressive shortening of the week and of the working day. It is of interest to note that one of the chief claims for a shortened week which is urged by trades unionists is the increased nervous strain which is put upon workers when they are compelled to perform "the same meaningless operations thousands of times a day." This view is in direct opposition to that expressed by Mr. Ford in his new book, which we reviewed last week.

The Kelvin Medal.

THE Kelvin Medal for 1926 has been awarded to the Hon. Sir Charles Parsons, and will be presented to him by Sir William Ellis, the President of the Institution of Civil Engineers, on October 26th, when Senatore G. Marconi will deliver the James Forrest Lecture, taking as his subject "Radio Communication." The award could scarcely have been made at a more opportune time, coming soon after the success of the high-pressure turbine steamer King George V., for which Mr. Harold Yarrow, Mr. Maurice Denny and Sir Charles were responsible. As is well known, the Kelvin Gold Medal was established in 1914 as part of a memorial to the late Lord Kelvin, and is awarded triennially by a standing committee, consisting of the Presidents of the principal representative British engineering institutions, for pre-eminence in the branches of engineering with which Lord Kelvin's scientific work and researches were closely identified. The first award was made in 1920 to Dr. W. C. Unwin, and the second in 1923 to Professor Elihu Thomson.

A Curious Derailment.

ON Tuesday, October 12th, a curious derailment mishap occurred on the Southern Railway, Eastern Section. As the 1.15 p.m. Charing Cross to Ramsgate express was approaching Waterloo Junction, just after the start of its journey, four of its coaches left the rails. A Pullman car in the middle of the train remained on the line. The coaches tilted over and fouled the up and down lines, but of the hundred or so passengers on the train none was hurt or suffered in any way. The electric current was cut off from the live rails of the section in which the accident happened, and the passengers were conducted along the line to Waterloo Station. Considerable disorganisation of the services was caused by the accident. Charing Cross Station was closed for several hours, and even after darkness fell London Bridge and Cannon-street Stations had to accommodate the bulk of the traffic. It was very noticeable that the new electric services responded efficiently to the call made on them for rearrangement at a moment's notice, and that the company's servants handled the dislocated rush-hour crowds with expedition and courtesy.

The Coal Dispute.

AT the miners' delegate conference in London on Thursday of last week, October 7th, it was revealed that, as anticipated, the voting in the districts on the Government's proposals showed an overwhelming majority against acceptance. The conference then proceeded to discuss and eventually to pass a resolution originating in South Wales under which a restoration of the conditions prevailing before the stoppage of work was demanded. Failing such restoration, the resolution urged the withdrawal of the safety men from the mines, the placing of an embargo on foreign coal, the stoppage of out-cropping, the obtaining of a levy from trade union sources, the conduct of propaganda in black areas, and the centralisation of control of the campaign in the hands of the executive to the supersession where necessary of local bodies. This resolution, subject to the approval of the districts as regards certain of its terms, has now become the basis of the miners' official policy. Its adoption was speedily followed by certain events which must now soon bring the dispute to an end. For one thing, it has automatically resulted in the final withdrawal of the Government's efforts to bring about a settlement by compromise. Secondly, it has called forth a strong expression all over the country of refusal on the part of the safety men, the majority of whom are not enrolled within the Miners' Federation, to leave their work. Thirdly, it has led one important district, that covering the county of Leicester, virtually to defy the Federation by entering into a district agreement with the local owners' association. Finally, it has served to open the eyes of many of the miners who were still holding back in the hope that a national agreement would even yet be reached. In spite of an immediate opening of a campaign of propaganda in the "black" areas, the return of the men to work has now assumed record proportions. Even in Lancashire and Yorkshire, the tide is flowing, and it is evident that the stoppage is well on the way to an end, despite the efforts of the national organisation to continue it on an intensified basis. The latest available figures indicate that nearly a quarter of a million workers are now engaged at the mines on the production of coal.

The Embargo and the Levy.

THE miners' demand for an embargo on the importation of foreign coal and their request for financial assistance by a general trade union levy were speedily answered at the annual Conference of the Labour Party which opened at Margate on Monday, October 11th. Mr. J. H. Thomas maintained that the first duty of the railwaymen's union was towards the 45,000 members who had not returned to their work since they left it at the beginning of the general strike on May 1st, and towards the 200,000 members who were still working only three days a week. Faced with these figures, it was hypocritical, he said, to talk about either an embargo or a levy. Mr. Tillett told a similar tale. The Transport Workers' Union, he said, had expended a million pounds on the dispute, and was now in debt to the extent of £500,000. With 80,000 members unemployed, and 100,000 under-employed, it was impossible for the moment to contribute to the proposed levy. A resolution which refrained from promising support to the miners by instituting an embargo and arranging a levy was on a card vote carried by a majority of over three million. As any embargo on foreign coal to be effective would primarily require the hearty support of Mr. Thomas's and Mr. Tillett's unions, it may be taken that the new miners' national policy will in this respect come to nothing. That there has been no restriction so far in the free importation of foreign coal is evidenced by the fact that since May the imports have totalled 10,837,697 tons, valued at £20,416,839. Both in August and in September the imports exceeded 3,900,000 tons. Actually, an embargo at this stage of the dispute would be fatuous. Ignoring the very considerable amount of coal being obtained at the outcrop workings, the mines of this country for the week ended October 9th produced nearly a million tons of coal, a figure showing an increase of about 200,000 tons over the output of the preceding week. From all quarters, it is reported that the output per man shows a considerable increase over the figure reached before the stoppage. At some collieries 29 cwt. per man per day is being produced, while on the average the weekly output per man is said to be about 5 tons, as compared with 4 tons in the pre-stoppage days.

Models and Analogies for Demonstrating Electrical Principles.

No. X.*

For the purpose of demonstrating the methods of winding armatures, G. Cussons, Ltd., of the Technical Works, Lower Broughton, Manchester, who are the manufacturers of Mr. Blake's valve model described in our issue of October 1st, have designed a number of armature models, as shown in Fig. 85, so that students may wind the cores with picture cord and bring the connections down to a dummy commutator, which is provided with screw clips

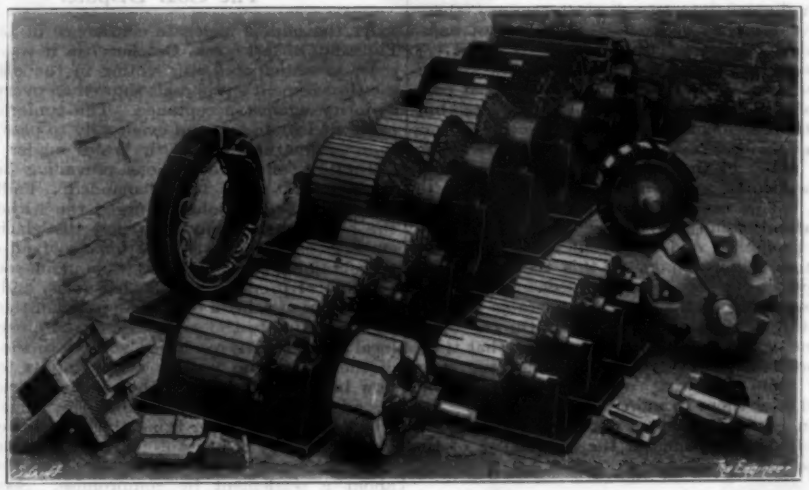


FIG. 85—MODELS OF D.C. ARMATURES AND AN ALTERNATOR

to clamp them. The armatures are sent out fully wound, and a typical section of the winding is marked in black or in some other colour which differs from that of the main winding. The illustration—Fig. 85—shows a collection of these models, which were sent some years ago to one of the colonial universities. The drum wound armature models are sent out in sets mounted on stands and serve to demonstrate different methods of winding, such as two-pole lap, two-pole wave, four-pole lap and four-pole wave windings. The illustration—Fig. 85—also shows models of an alternator stator and rotor, &c., and an armature core provided with an old-fashioned Gramme winding. Enlarged views of the Gramme-wound armature and the field of an alternator are

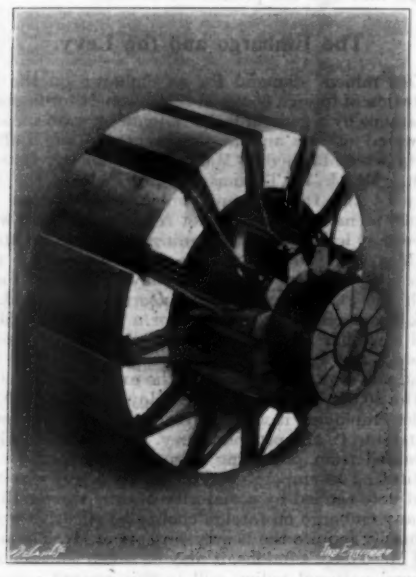


FIG. 86—RING ARMATURE MODEL

given in Figs. 86 and 87, whilst Fig. 88 shows a model of a three-phase alternator stator winding. Fig. 89 shows a model of an armature with a six-pole two-circuit winding. Another product of this firm is shown in Fig. 90, which illustrates a model designed to demonstrate to a class of students the general construction and arrangement of the windings on a direct-current motor with interpoles. The poles may be detached and windings of picture cord may be arranged to indicate various electro-magnetic systems.

For demonstrating the principle of three-phase currents, Dr. Edward Hughes, head of the electrical engineering department at the Technical College, Brighton, has devised the arrangement shown in Fig. 91. A circular or rectangular metal plate with three narrow slots, 120 deg. apart, is placed over a circular piece of glass attached to a toothed metal rim, which is housed so that it can be rotated by a handle, as shown, and the whole arrangement is mounted so that it can be placed in a projector instead of the usual slide carrier. On the glass two circular areas are painted red and blue respectively, the diameter of each circle being equal to the length of a slot. Three slots or arms radiating from the centre are therefore projected upon the screen and on these arms various lengths of coloured light are seen, the glass plate with the coloured areas being capable of being rotated whilst the metal plate with the slots is fixed.

Assuming the current to be positive when flowing from the star point outwards, it will be represented by the red light; and the length of the red portion of a slot represents the instantaneous value of that current. By rotating the disc and by watching one of the slots, it can be seen how the current increases in the positive direction, then decreases, reverses, &c., and that when the complete cycle has been completed it is repeated *ad infinitum*. Students can also follow what is taking place in the other phases. If the plate is rotated in a clockwise direction, it can be shown how the current in phase B attains its maximum value 120 deg. after that in phase A, but 120 deg. before that in phase C. Moreover, it can be shown that the algebraic sum of the currents is zero at every moment. At the instant represented

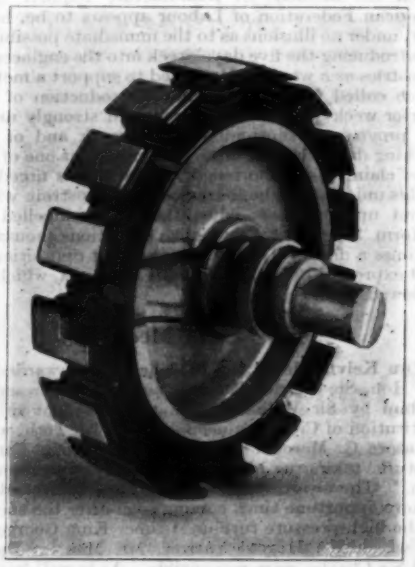


FIG. 87—ALTERNATOR FIELD MAGNET MODEL

in Fig. 91, for example, the current in phase C is at its maximum positive value, whilst the currents in phases A and B are half the maximum value and are flowing inwards. It is therefore possible to trace the changes in the three-phase currents from moment to moment. Anyone who has taught the theory of three-phase circuits will appreciate the difficulty of getting students to form a mental picture of what is taking place in such circuits, and it was for that reason that the above model was devised.

Dr. Hughes has also devised a method of demonstrating the beat effect obtained in supersonic heterodyne wireless receivers. The apparatus for this purpose which we have already described, involving the use of organ pipes, has, Dr. Hughes points out, a certain weakness, for the fundamental sound is heard, the beats being simply a variation of that sound; whereas with high-frequency heterodyning nothing is heard unless the high-frequency oscillations are rectified. In order to remove this discrepancy, Dr. Hughes has devised a simple model, as shown in Fig. 92. Two systems A and B, consisting of a spring and weight, are independently supported, so that no vibration is communicated from one to the

FIG. 88—STATOR MODEL

other, and they are adjusted so that they have practically the same natural frequency. The lower ends are connected by a string D, which is so loose that each system can oscillate freely, whilst behind the string D there is a narrow strip of material such as a ruler or pencil C. If one system be set oscillating the mid-point of the string D simply travels up and down

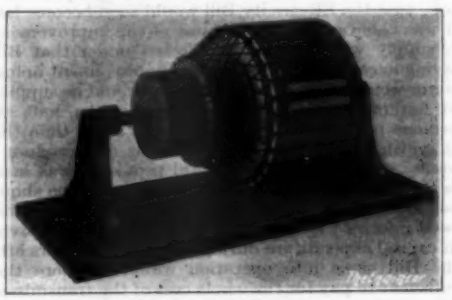


FIG. 89—ARMATURE MODEL

at the same frequency, and the amplitude dies down slowly as that of the oscillating system decreases. If the two systems are set oscillating simultaneously, then at one moment the weights W^1 and W^2 move up and down together, and the mid-point of the string D oscillates at its maximum amplitude. After a time, however, system B begins to get out of step and the

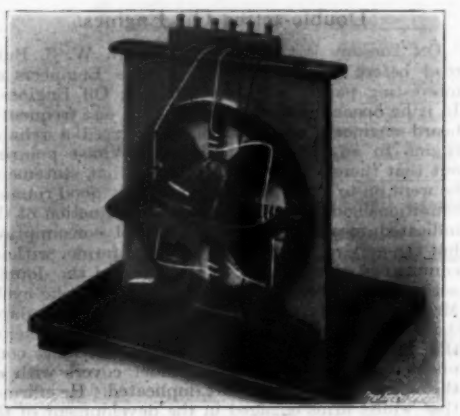


FIG. 90—D.C. MOTOR MODEL

amplitude of movement of the mid-point of D decreases, but it still oscillates up and down until when the weights W^1 and W^2 are moving in exact phase opposition, the mid-point of the string D becomes stationary. Afterwards, however, the systems A and B begin to get into phase with one another, with the result that the mid-point of D begins to move up and down with increasing amplitude. The variation in the amplitude of the up and down move-

* No. IX. appeared October 8th.

ment of D relatively to C is shown in Fig. 93. The effect of altering the frequency of the beat can be shown by adding a slight load to, say, the weight W¹. Such a model has the advantage of showing that a high-frequency oscillation is still being dealt with in the beat, if the two sources are high-frequency oscillations, and hence indicates the necessity of wiping

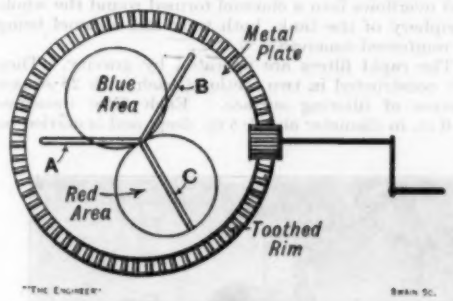


FIG. 91—MODEL FOR DEMONSTRATING THREE-PHASE CURRENT

out one side; or, in other words, of rectifying, if the beat effect is to be made audible.

American teachers and writers on electrical subjects appear to use analogies more extensively than those in this country, and many analogies are to be found in American text-books. From "Advanced Electricity and Magnetism," by Franklin and Macnutt, published by the Macmillan Company, the mecha-

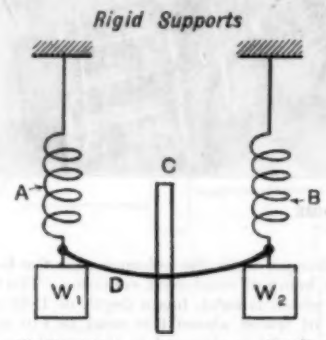


FIG. 92—METHOD OF DEMONSTRATING BEAT EFFECT

nical analogy of the transformer—shown in Fig. 94—is taken. The use of the lever for the multiplication of mechanical force is familiar to everyone, and the alternating-current transformer is shown by the authors of this book to be mathematically analogous to a lever having a massive fulcrum which is free to move. If the wheels of the mass M are frictionless, a steady force would eventually produce an in-

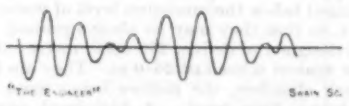


FIG. 93—CURVE SHOWING VARIATION IN AMPLITUDE

definitely large velocity of the mass M. The lever shown in Fig. 94 can only be used for multiplying a rapidly alternating force applied to the end A. Similarly, a steady electromotive force would eventually produce an indefinitely large current through the primary coil, with a small resistance, and the transformer, like the lever, can only be used for multiplying a rapidly alternating electromotive force

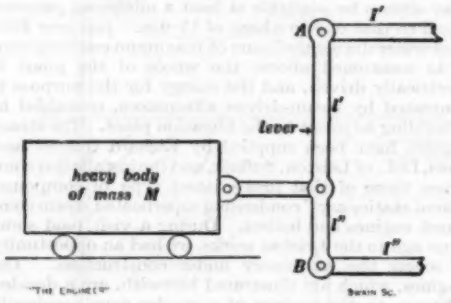


FIG. 94—TRANSFORMER ANALOGY

applied to the primary coil. Imagine a very rapidly alternating force applied to the end A of the lever—Fig. 94. The end A will then move with large backward and forward velocity, whilst the end B will make corresponding small backward and forward movements, but the end B will exert a large force. If an alternating electromotive force be applied to the primary coil of a step-up transformer, a relatively large current will flow backwards and forwards through that coil, whilst a small current flows in a similar manner in the secondary coil, which, however, acts upon the receiving circuit with a large electromotive force. If we ignore the slight movement of the heavy body, we have $\frac{e'}{e''} = \frac{l''}{l'}$ and $\frac{i'}{i''} = \frac{l''}{l'}$, where at any instant e' is the force exerted on the end A, i' the velocity of the end A, e'' the force exerted by the end B, and i'' the velocity of the end B. Similarly, if we ignore the small current through the primary coil which magnetises the iron core, we have $\frac{e'}{e''} = \frac{Z'}{Z''}$ and $\frac{i'}{i''} = \frac{Z''}{Z'}$, where at any instant e' is the electromotive force acting on the primary coil, i' the current flowing through the primary coil, e'' the electromotive force induced in the secondary coil, and i'' the current flowing through the secondary coils. Z' and Z'' represent the primary and secondary turns. The analogy outlined is complete, but it is not considered necessary to develop it in full. The movement of the mass M, for instance, is exactly analogous to the magnetising current in a transformer, and the mass of the lever itself leads to behaviour which is exactly analogous to magnetic leakage in a transformer. This latter is indeed developed in Messrs. Franklin and Macnutt's book, but from a point of view somewhat different from the usual discussion of magnetic leakage in transformer theory.

Another interesting mechanical analogy given in Messrs. Franklin and Macnutt's book relates to coupled circuits containing capacity. A common arrangement of apparatus at the sending station for

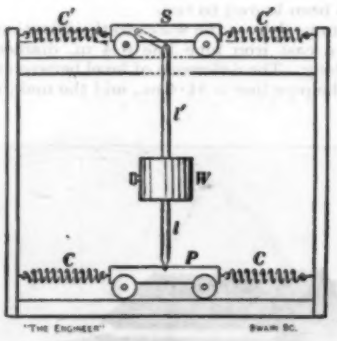


FIG. 97—COUPLED CIRCUIT MODEL

wireless telegraphy is shown in Fig. 95. The condenser C is charged from a high voltage supply a b, until the spark gap breaks down, when the charge from the condenser surges backwards and forwards through the circuit C P. The coil P is the primary of a transformer of which the secondary is the coil S. The current surging through the primary circuit C P induces an alternating electromotive force in the secondary coil S, and this induced electromotive force causes current to surge up and down in the aerial, when the energy is largely radiated in the form of electric waves. Fig. 96 shows a similar arrangement in which there is no appreciable radiation from the secondary circuit S C¹. The two circuits C P and S C¹ are said to be coupled through the transformer P S. A mechanical arrangement which is completely analogous to Fig. 96, is shown in Fig. 97, in which the lever l l' and the weights W correspond to the transformer shown in Fig. 96, and the springs C and C¹ correspond to the condensers in Fig. 96. The details of behaviour of the coupled circuits can be strikingly demonstrated with the help of the arrangement shown in Fig. 97, as follows:—The primary system P C has a definite frequency of oscillation when the car S is held fast, and the secondary system S C¹ has a definite frequency of oscillation when the car P is held fast. When these two frequencies are adjusted to equality, the primary and secondary circuits are said to be tuned to each other. The ratio of transformation of the transformer shown in Fig. 96 is represented by the ratio of the two lever arms l and l'. When the weight W is very large or when the weights of the cars P and S are large, or when the weight W is small, the model demonstrates a loose coupling. When the primary system P C is set oscillating, a series of force impulses is transmitted

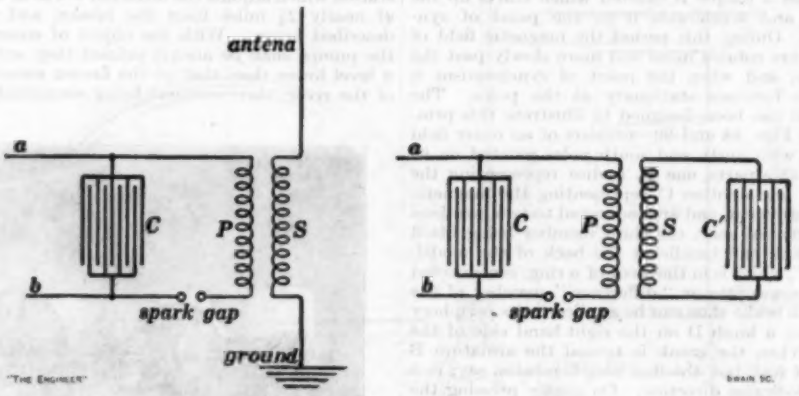


FIG. 95 AND 96—WIRELESS TELEGRAPHY TRANSMITTING CIRCUITS

to the secondary system S C¹ by the lever and the secondary system is quickly set into oscillation. When the primary and secondary systems are in tune with each other, the whole of the energy of oscillating primary system is transformed into the secondary system, and the primary system comes momentarily to rest. The energy is then transformed

FIG. 98—ROTARY CONVERTER MODEL

back from the secondary to the primary, and so on repeatedly. When the primary and secondary systems are not in tune with each other only a definite fractional part of the energy of the primary system is transformed to the secondary, this fraction depending upon the closeness of the coupling and upon the

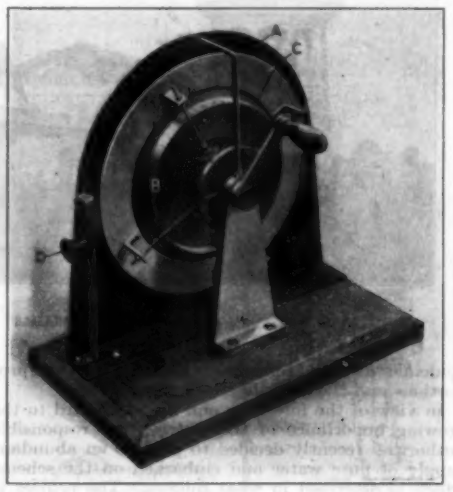


FIG. 99—BACK VIEW OF ROTARY MODEL

closeness of tuning of the primary and secondary systems.

The same authorities show that a great help to the clear understanding of the elementary theory of electricity and magnetism is afforded by the identity of many of the equations of mechanics and electricity.

A model has been developed in the engineering laboratory of the British Thomson-Houston Com-

pany for the purpose of illustrating the action of the starting of a synchronous motor or rotary converter by applying a reduced voltage to its armature. This method of starting rotary converters is, of course, known as tap starting, and the application of current at reduced voltage to the slip rings produces in the armature a magnetic field, which rotates in the opposite direction to that normal for the armature. On account of eddy and hysteresis losses in the fixed field system a torque is exerted which starts up the armature and accelerates it to the point of synchronism. During this period the magnetic field of the armature rotates more and more slowly past the field poles, and when the point of synchronism is reached it becomes stationary at the poles. The model that has been designed to illustrate this principle—see Figs. 98 and 99—consists of an outer field system A with north and south poles painted on it. Two rotatable parts, one B, a disc representing the armature, and another C, representing the magnetic field, are provided, and are connected to two members of a differential gear, the third member being fitted with a crank and handle at the back of the model. The part C, which is in the form of a ring, is connected to the intermediate or "difference" member of the gear, and a brake shoe can be applied to its periphery by pressing a knob D on the right-hand side of the model. When the crank is turned the armature B remains at rest, but the flux ring C rotates, say, in a counter clockwise direction. On gently pressing the knob D a braking action, representing eddy and hysteresis loss, is applied to the flux ring, and this produces a torque on the armature A through the medium of the differential gear, which accelerates clockwise, whilst the flux member drops in speed, and when the latter becomes stationary with the tufts of the flux opposite the fixed poles, the armature is running at full speed, and is in synchronism. Fig. 98 shows a front view of the model, and Fig. 99 the gearing at the back.

We are indebted to Mr. Clinker of the British Thomson-Houston Co., for particulars of this model, which was designed in the company's laboratories.

New Waterworks for the City of Posadas.

The City of Posadas, the capital of the Misiones Territory of the Argentine Republic, is situated on the left bank of the Upper Paraná River, and in 1914—the date of the last census—it had a population of 10,200, though that number has since considerably increased. The water supply was, until quite recently, effected by primitive means. There was, first of all, sale from house to house of river water taken round in carts. Then there were wells varying in depth from 5 m. to 20 m.—say, from 16ft. to 65ft.—and, finally, there were, in some buildings, cisterns for collecting and storing rain water. As can well be understood, therefore, the quality of all the water was by no means always above suspicion, and because of that, and because of the hot climate of the district, epidemic diseases sometimes attained serious proportions and the mortality rate was high.

POSADAS WATERWORKS

In view of the foregoing and having regard to the growing importance of the district, the responsible authorities recently decided to provide an abundant supply of pure water and embarked on the scheme which is described in what follows. The project is based on an eventual population of 30,000, and on a daily consumption of 350 litres—or, say, 77 gallons—per head, which represents a total of 10,500,000 litres, or 2,310,000 gallons, per day. For the present, however, only sufficient capacity for the needs of a town of 15,000 inhabitants at 350 litres per head per day has been provided.

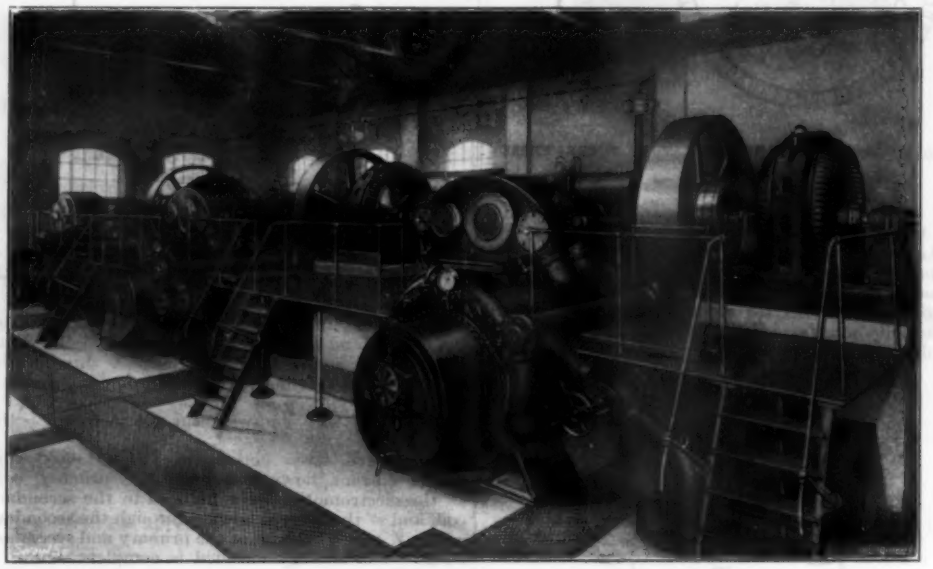
The source of supply is the River Paraná, which, it is said, can furnish a water that, after filtration, is of excellent quality. The water is abstracted from the river at a point above the city, and approximately 700 m. from the mouth of the Tablada stream. The intake works consist of a cast iron pipe, 0·35m. in diameter and 290 m. long, arranged at right angles to the direction of the current, and laid in the bed of the river. On the bank there is a pump house containing two pumping units, each designed to raise 220 cubic metres of water per hour against a head of 70 m. The pumps are of the vertical spindle centrifugal type, and are electrically driven, the current being obtained from a specially built generating station which adjoins the filtration works at a distance of nearly 2¼ miles from the intake, and which is described below. With the object of ensuring that the pumps shall be always primed they are fixed at a level lower than that of the lowest recorded level of the river, their suctions being connected directly to the intake pipe. Each pump has its own isolating valve.

The electric motors are fixed at a higher level than that of the highest known level of the river, the length of vertical shafting coupling each motor to its pump being 7·5 m. The chamber which contains the pumps is excavated in the solid rock, and immediately above it there has been built a small brick edifice, measuring 4·2 m. square, in which the motors are installed. Its floor is 2·3 m. above the ground level, which is well above the highest level to which the river has been known to rise.

The pumps deliver the water to the filtration works through a cast iron pipe line 0·4 m. diameter and 3450 m. long. The difference of level between the two ends of the pipe line is 54·4 m., and the main is fitted with the customary retaining, air, shut-off and cleaning valves. At the filtration works the piping is divided into two branches, one of them being for providing the circulating water for the surface condensers of the steam engines which will be described later. By means of a combination of valves, the whole or a portion of the water can be made to circulate through the condensers, or the latter can be entirely isolated. A Venturi meter fixed near the engine house is employed to measure the quantity of water passing through the pipes.

Since the river water usually has in suspension a large quantity of clay and organic matter, it is necessary for it to be clarified and purified before it can be distributed for consumption, and mechanical filters have been adopted as being the most simple, economical and efficient for the purpose. The installation for the purification of the water includes a reception reservoir, a battery of rapid filters and a further reservoir for the filtered water. The pumps at the intake deliver the river water into a circular tank, 14·5 m. in diameter and 2·3 m. deep, and coagulant to facilitate the precipitation of the matter in suspension is then added. The size of the reservoir has been made such that the treated water will remain some two hours in it before it passes to the filters. The water enters the reservoir at the centre, and overflows into a channel formed round the whole periphery of the tank, both tank and channel being of reinforced concrete.

The rapid filters are operated by gravity. They are constructed in two sections, each with 28 square metres of filtering surface. Each filter measures 6·0 m. in diameter and 2·8 m. deep, and is carried on twelve columns, both the columns and the bodies of the filters being of reinforced concrete. The filtering material, which is sand, has a depth of 1·65 m., and the head of water above the sand is 1·0 m. The filtering material is cleansed in the usual manner by reversing the direction of the flow of water through it.



INTERIOR OF ENGINE HOUSE

Near the filtration building there is a covered reservoir for storing the filtered water. It is circular, 22·0 m. in diameter and 4·0 m. deep, and it has a capacity of 1500 cubic metres, or, say, 330,000 gallons. It is of reinforced concrete, and is covered with soil.

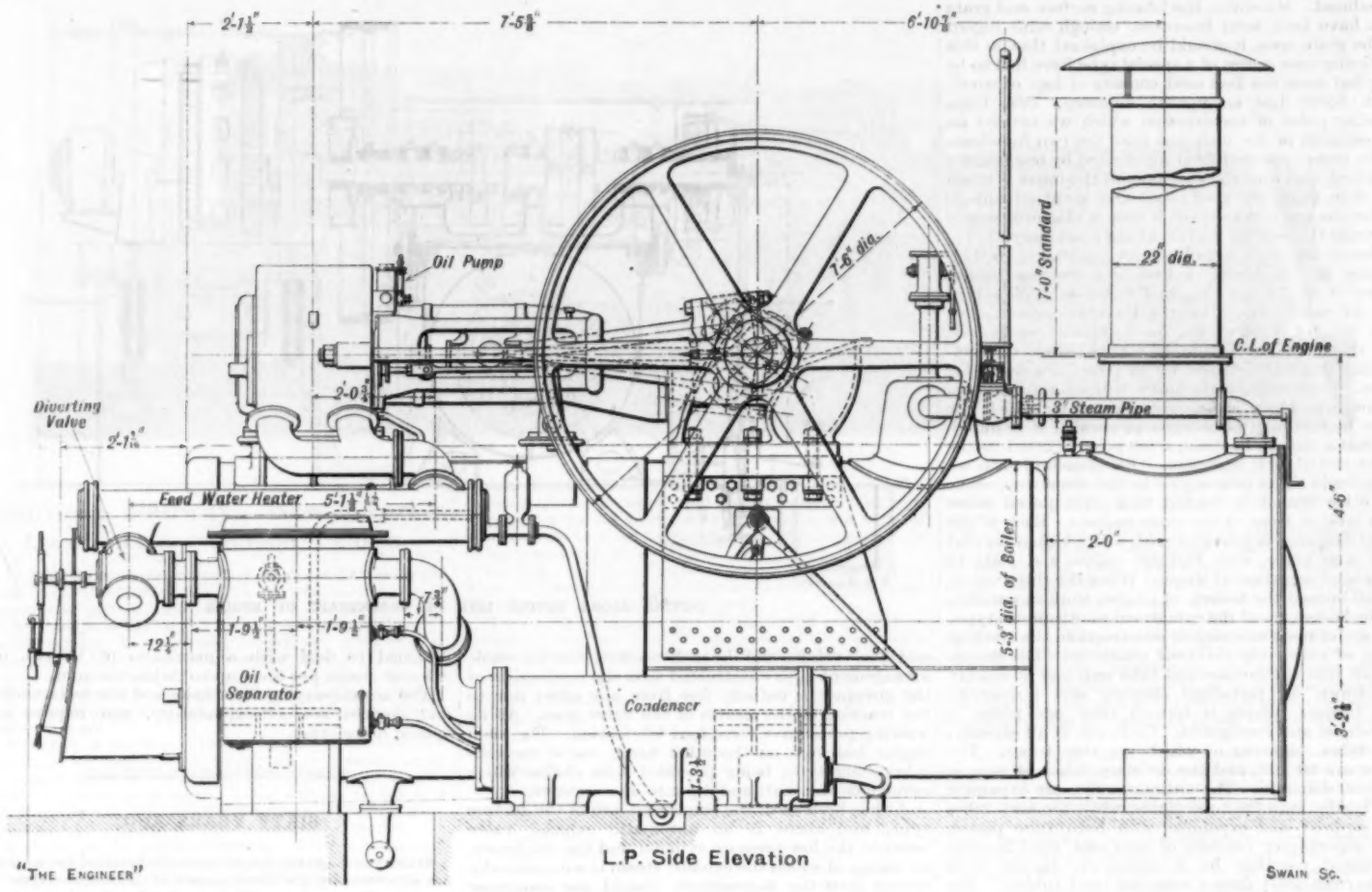
The pumps which raise the water from the filtered water reservoir to the distribution reservoir, or deliver it into the network of mains laid in the city, are of the vertical spindle centrifugal type, driven by electric motors. Their suctions are connected directly to the outlet pipe from the filtered water reservoir, and they are arranged below the minimum level of water in the reservoir, so that they may be always primed. Each pump is designed to deliver 270 cubic metres of water per hour against a head of 26·0 m. They are housed in a brick chamber, the motors being fixed at the engine house floor level. A high-level reinforced concrete service reservoir, which has a capacity of 500 cubic metres—110,000 gallons—and is roofed in, is circular in shape, and has an internal diameter of 13·5 m. The arrangement of the piping and valves is such that the pumps can be made to deliver either into the reservoir or direct into the mains, or both simultaneously. To begin with, distribution mains to a total length of 45,540 m.—roughly 28½ miles—have been laid. They vary in diameter from 0·35 m. to 0·05 m. The sizes of the mains and pipes have been so calculated that in all parts of the network there may always be available at least a minimum pressure equal to that due to a head of 15·0 m.—just over 49ft.—of water during the hours of maximum consumption.

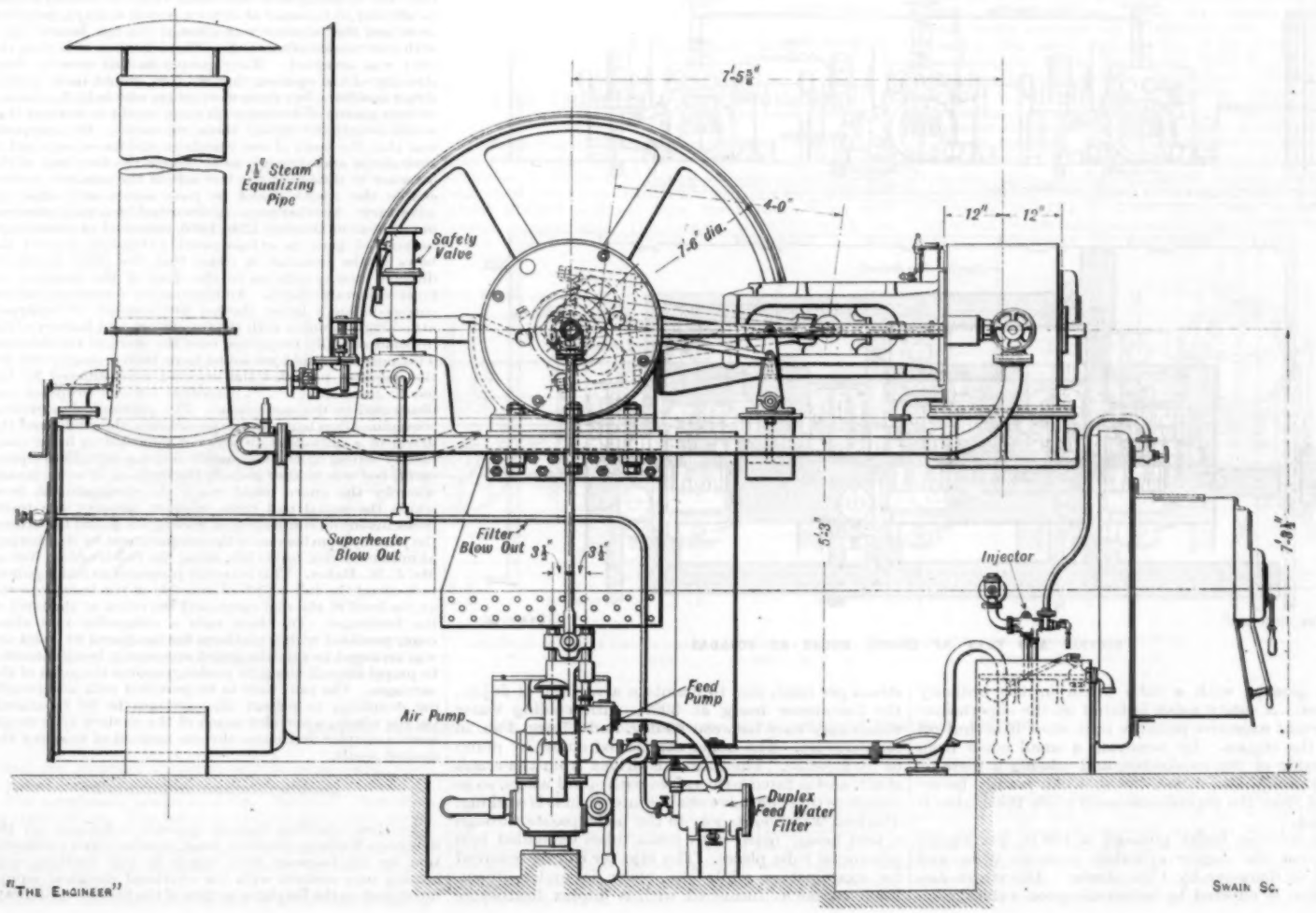
As mentioned above, the whole of the plant is electrically driven, and the energy for the purpose is generated by steam-driven alternators, contained in a building adjacent to the filtration plant. The steam engines have been supplied by Richard Garrett and Sons, Ltd., of Leiston, Suffolk, and the installation comprises three of that firm's latest type of compound "semi-stationary" condensing superheated steam combined engines and boilers. During a visit paid some time ago to the Leiston works, we had an opportunity of seeing the machinery under construction. The engines, which are illustrated herewith, are a decided advance on the engines of a similar type previously made by the firm, being of more robust design. They now embody a circular smoke-box and a circular tubed superheater of the coil type fitted with cast steel headers. The crank case and cylinders are tied together by rods, so that the whole engine forms a single unit. Only the crank case is tied to the boiler, the cylinders being left free to move in a slide when the boiler expands and contracts. The position of the crank shaft is therefore definitely fixed, and is unaffected by changes of temperature.

Each engine is rated at 140 brake horse-power

POSADAS WATERWORKS—140 B.H.P. "SEMI-STATIONARY" STEAM ENGINE

RICHARD GARRETT AND SONS, LTD., LEISTON, ENGINEERS





continuous load and 160 brake horse-power overload at 187·5 revolutions per minute, and each is connected by flexible couplings to a 100-kilowatt alternator.

As compared with earlier types, the construction of the boiler has been modified, some considerable improvements in methods of manufacture—including dished instead of flanged end plates—having been introduced. Moreover, the heating surface and grate area have both been increased, though with regard to the grate area, it should be explained that in this particular case grates of a special type have had to be supplied since the fuel used consists of logs of wood. Each boiler has an uptake chimney, 75ft. high. Another point of construction which we noticed on the occasion of our visit was that the two fly-wheels of the older type had been superseded by one heavier fly-wheel, and that the overhang of the latter is much less than in earlier machines. One great advantage of the change is that there is now a platform nearly all round the moving portion of the machinery.

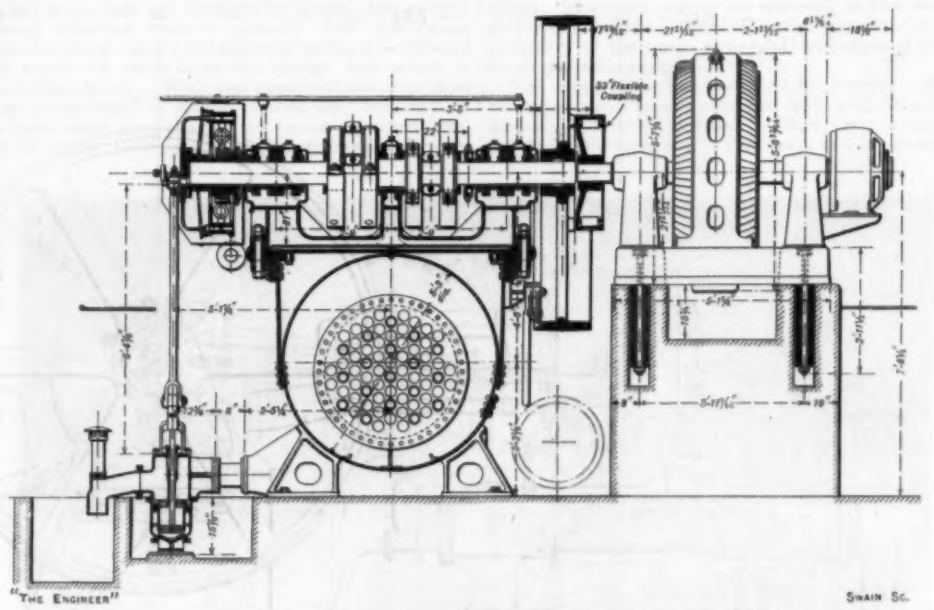
Messrs. Garrett's usually fit jet condensers to their engines of this type; indeed, a somewhat similar engine shown at the Empire Exhibition at Wembley had jet condensers. But the Posadas engines, since they are for waterworks, have surface condensers, and there are no circulating pumps, since the condensing water is obtained by by-pass from the rising main. Ordinarily, each boiler will operate its own engine, but there is an arrangement by which the three boilers may be worked in parallel if required. To enable this to be done, a tee piece is fitted to the outlet end of each separator. One branch of each tee piece leads to its own engine in the usual way, while the other branch is jointed to a pipe placed below floor level in front of the three engines. Each of the latter branches is provided with a Hopkinson parallel slide stop valve, with Platnam valves and seats to withstand superheated steam. When the three valves are all opened the boilers, of course, work in parallel.

The boilers are of the cylindrical multitubular type, and are of most substantial construction, the riveting being of noticeably excellent character. The design is such that the furnace and tube unit can be readily withdrawn for periodical cleaning and inspection. The furnace, which is formed from one plate, is cylindrical and corrugated. There are in all seventy-two tubes, eighteen of which are stay tubes. The latter are 60 mm. and the ordinary tubes 64 mm. in internal diameter. The ordinary tubes are expanded and beaded into the tube plates, while the stay tubes are screwed and expanded into both tube plates. The superheater consists of two cast steel headers connected together by a series of zig-zag coils made from solid drawn seamless steel tubing. The ends of the coils are expanded into the steel headers, which are provided with screwed plugs opposite the ends of all the tubes for that purpose. The complete superheater is arranged in the smoke-box clear of the boiler tubes, a construction which allows of the latter being cleaned with a tube brush in the ordinary manner. A safety valve is fitted on the superheater to prevent excessive pressure in it when it is shut off from the engine. By removing a small cover from the inside of the smoke-box and passing a metallic hose through the orifice, the soot can readily be removed from the superheater coils while the engine is running.

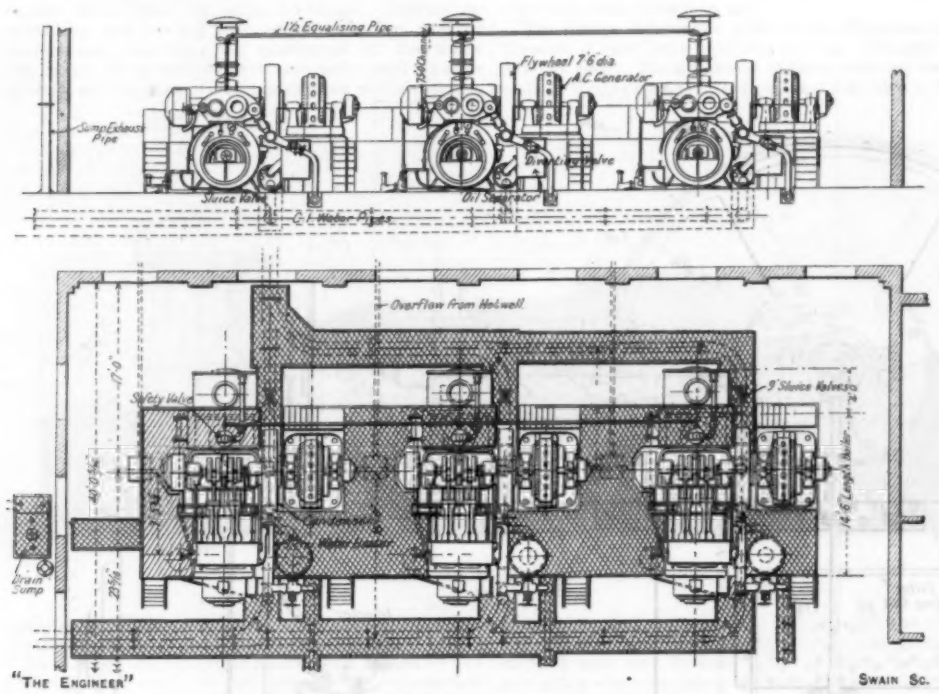
The working boiler pressure is 190 lb. per square inch, and the engine cylinders measure 9¾in. and 16¾in. in diameter by 17in. stroke. The steam distribution is effected by balanced piston valves, each fitted with four rings and lubricated by a positive feed oil pump. Both the cylinders and piston valves have metallic packing in the glands. The governor, which operates on the high-pressure piston valve, is of the automatic expansion type. It consists of a hollow circular frame containing two pivoted weights and steel springs, and the makers claim that the whole arrangement is so constructed that the mechanism of the governor is entirely free from any effect due to the reaction of the inertia of the valve gear. All its wearing parts have force feed lubrication. The main engine bearings, on the other hand, are of the self-lubricating type, being provided with chains which revolve on the shaft and dip into oil reservoirs.

As has been said, the condensers are of the surface type, and there is an automatic exhaust valve between the low-pressure cylinder and the condenser, by means of which the exhaust steam is automatically turned into the atmosphere, should the condenser not be required. The air pump, which is of the Edwards type, is bolted on one of the pedestals supporting the boiler. It is driven by a crank pin on a disc at the end of the crank shaft. Each condenser is designed to deal with 1960 lb. of exhaust steam per hour, and to maintain a vacuum of 26½in., the barometer being at 30in., with cooling water which may vary between 68 deg. and 77 deg. Fah. in temperature. The boiler can be fed either by pump or by injector. The former is driven from the crank shaft, and is fitted with valves with spiral wings, so as to ensure that the valve shall rotate when it is working. The feed water on its way to the boiler passes through a feed heater fitted with brass tubes expanded into gun-metal tube plates. The injector can be removed for examination while the boiler is under steam. Each engine is furnished with a duplex feed-water filter designed to deal with 1960 lb. of water per hour. It is placed on the delivery side of the feed pump. Each half of the filter can deal with the full volume of feed water, and there is a change-over valve, so that one-half can be cleaned while the other is at work. Each engine has also a Baker oil separator designed to deal with a maximum of 1960 lb. of exhaust steam per hour up to 26½in. vacuum.

The accompanying illustrations of the waterworks and engines are self-explanatory, and require no special description.



SECTION ALONG CENTRE LINE OF CRANKSHAFT OF ENGINE



SECTION AND PLAN OF ENGINE HOUSE AT POSADAS

SIXTY YEARS AGO.

Sixty years ago the Americans had surprised the world's naval powers by the development of the monitor type of warship. The monitor, with its low freeboard and armoured turret, seemed to introduce a factor into naval warfare with which the ironclads of the time could not deal effectively. One American monitor had demonstrated by crossing the Atlantic to Europe that the design possessed good sea-going qualities and was not, as had been extensively argued, purely adapted for coastal defence. As this monitor, the Miantonomah, lay among our fleet at Sheerness, the sporting offer was made that our vessels should be allowed to hammer at it for a period of days, provided in return the monitor was allowed "a few hours' fun" with our vessels afterwards. There is no record that the offer was accepted. Many people in this country were strongly of the opinion that we, too, would have to construct monitors, but there were others who held that sooner or later means of dealing with them would be devised that would eventually render them innocuous. One proposal was that the bows of our vessels should be constructed of such shape and strength as to enable the fore foot of the attacker to slide over the low side of the monitor, and so enable the whole vessel to pass across and sink her adversary. Another proposal described by a correspondent in our issue of October 12th, 1866, consisted of mounting a battery of guns in a framework extending beyond the bows of the ironclad in order that the shots might be directed downwards on to the deck of the monitor, its most vulnerable point. An illustration accompanying our correspondent's letter showed an ironclad so equipped attacking a monitor with the framework and battery of the ironclad actually projecting over the stern of the monitor. This position would no doubt have been a deadly one for the monitor, provided the ironclad were suffered by her foe to reach it. . . . Another curious proposal was illustrated in the same issue. The problem of providing communication between the passengers, the guard and the driver of a railway train was not regarded as being completely solved by the use merely of some signalling equipment, but was held to include the devising of some means whereby the guard could reach the compartment from which the signal had come without stopping the train. Some inventors contemplated leaving the guard to perform the journey from his van to the compartment by clambering, at imminent risk to his life, along the footboards. Not so Mr. J. W. Baker. This inventor proposed to run a pair of rails along the full length of one side of the train, one rail at the level of the roof eaves and the other at the level of the footboard. On these rails a collapsible four-wheel cage, provided with a platform for the guard to stand on, was arranged to run, the guard apparently being intended to propel himself along by pushing against the sides of the carriages. The rails were to be provided with self-detaching couplings to permit the carriages to be separated. On the whole, a corridor coach of the modern type would seem a simpler and more obvious method of reaching the desired result.

At East Croydon Station recently a fireman on the Southern Railway received fatal injuries from electrocution by the hammer with which he was breaking coal coming into contact with the overhead electrical equipment used on the Brighton section of the Southern Railway.

SOUTHERN RAILWAY—FOUR-CYLINDER SIMPLE PASSENGER ENGINE

MR. R. E. L. MAUNSELL, M.I. Mech. E., ENGINEER

Southern Railway—New Express Locomotive, "Nelson" Class.

In order to meet the increasing weight of fast passenger traffic on the Southern Railway, a new and heavier type of locomotive, built at the company's works at Eastleigh to the designs of Mr. R. E. L. Maunsell, the chief mechanical engineer, has just been introduced. This engine, named Lord Nelson, and the first of a class which will be known as the "Nelson" class, is a 4–6–0 four-cylinder simple superheater engine with double bogie tender, slightly heavier and more powerful than the well-known "King Arthur" type.

The drive of the four cylinders is divided between two axles, and the angles of the cranks are so arranged as to give eight separate impulses per revolution of the wheels, with the object of obtaining more uniform torque and more regular fire-box draught than is possible in a four-cylinder engine arranged with "quartered" cranks.

A glance at the ample proportions of both boiler and running gear will show that the moderate weight of this powerful machine has been secured by close attention to design of details.

About two years ago Mr. Maunsell tried out this arrangement of cylinders and cranks by altering one of the late Mr. Dugald Drummond's four-cylinder engines. This engine—No. 449—as originally arranged, had the four cylinders (two inside and two outside the frames) driving on two axles with the cranks "on the quarters" and having the usual four impulses per revolution, and the alteration made was to turn the cranks of the inside engine through 45 deg. and to re-balance the wheels to suit. The improvement secured by this alteration was so remarkable that Mr. Maunsell decided to embody the arrangement in the engine now under notice.

Four Walschaerts valve gears are employed, and the revolving and reciprocating parts have been made as light as possible by using a special high-tensile steel, and the advantage gained thereby is also reflected in the lightness of the balance weights necessary in the wheels.

The boiler has a working pressure of 220 lb. per square inch and is of the "Belpaire" type, the fire-box water space stays being of steel in the fire area with nuts on the fire side and ordinary riveted copper stays elsewhere. The tubes are of moderate length, there being 173 small tubes, 2in. external diameter, and 27 large tubes, 5¼in. external diameter.

The superheater header is of the "Maunsell" type with air relief valves. The boiler mountings are of new design and the fire-door is of the sliding type. Other fittings include soot blower, exhaust injector, and four-feed sight-feed lubricator with separate condenser for the cylinders and valve chests.

The cab has side windows and is of similar design to that of Mr. Maunsell's latest 4–4–0 type engines. The engine bogie is of simple and robust construction with side control springs arranged for adjustment and removal from the outside of the frame, while side steadying bearings to the main frame are provided.

The bogie tender is similar to that used on the "King Arthur" class, but the tank has flat sides. The air brake reservoirs are mounted on the tender.

The overall dimensions of the engine will permit of its working on the main lines of any section of the company's system. The leading particulars are as follows:—

Boiler barrel—	
Outside diameter at fire-box	5ft. 9in.
Length	13ft. 9in.
Length between tube plates	14ft. 2in.
Fire-box shell—	
Width	4ft. 0½in.
Length	10ft. 6in.
Heating surface—	
Fire-box	194 sq. ft.
Small tubes	1282 sq. ft.
Large tubes	513 sq. ft.
Total	1989 sq. ft.
Superheater surface	376 sq. ft.
Grate area	33 sq. ft.
Cylinders	(four), 16½in. dia. by 26in. stroke
Coupled wheels	6ft. 7in. dia.
Bogie wheels	3ft. 1in. dia.
Tractive effort at 85 per cent. boiler pressure	14·95 tons
Weight of engine in working order	83 tons 10 cwt.
Weight of tender in working order	56 tons 14 cwt.
Total weight	140 tons 4 cwt.

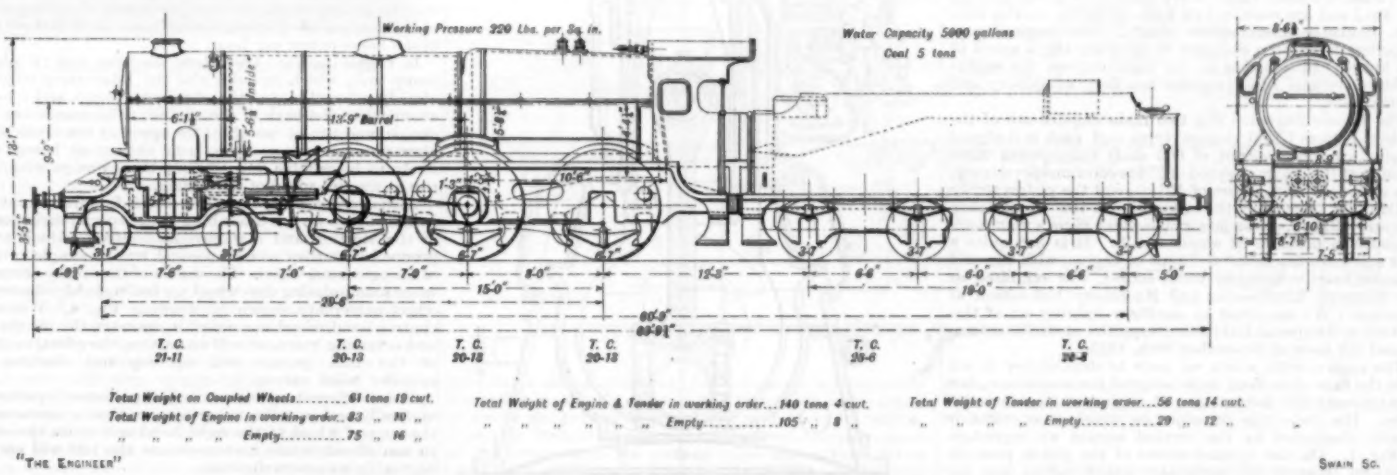
The Quarter's Shipbuilding.

Lloyd's Register shipbuilding returns for the quarter ended September 30th show that the tonnage under construction in Great Britain and Ireland—774,797 tons—was 66,541 tons less than at the end of June, 1926, and about 234,000 tons less than the tonnage being built twelve months ago. The tonnage on which work was suspended at the end of September, 1926, amounted to 107,498 tons, which is about 26,000 tons more than at the end of September, 1925. The present totals are the lowest recorded since June, 1909, and are 1,115,000 tons below the average tonnage building during the twelve months immediately preceding the war, *i.e.*, 1,890,000 tons. An enormous decrease is shown in the tonnage commenced during the quarter, namely, 68,327 tons, as compared with 168,483 tons during the second quarter of 1926. The tonnage launched during the quarter, 207,741 tons, was 36,016 tons higher than that for the previous three months.

The total merchant tonnage being built in other countries—1,075,900 tons—was about 53,000 tons less than at the end of June, 1926. The tonnage under construction abroad exceeded by 301,103 tons the tonnage being built in Great Britain and Ireland. The figures for the leading countries abroad were:—Italy, 278,764 tons; Holland, 160,604 tons; France, 134,985 tons; Germany, 127,321 tons; and United States, 119,723 tons. From one of the tables it is seen that 200,027 tons were commenced abroad and 178,821 tons were launched, an increase, as compared with the previous quarter, of 36,794 tons in the tonnage commenced, and a decrease of 25,243 tons in the tonnage launched.

The total world tonnage under construction—1,850,697 tons—showed a decrease of about 120,000 tons, as compared with the previous quarter, and was 1,595,861 tons below the highest pre-war record reached on June 30th, 1913, viz., 3,446,558 tons. There are at the present time under construction in the world twenty-three vessels of between 10,000 and 20,000 tons each, and eleven of 20,000 tons and upwards. Fourteen out of the twenty-three and three of the larger vessels are being built in Great Britain and Ireland. The total figures include thirty-nine steamers and motor ships, each of over 1000 tons, with a total tonnage of 251,933 tons, under construction in the world for the carriage of oil in bulk. Of these tankers, fourteen, of 87,380 tons, are under construction in Great Britain and Ireland, and ten, of 62,360 tons, in Holland.

The tonnage of vessels now being built in the world, which are to be fitted with internal combustion engines, amounts to 869,509 tons, while the tonnage of steam vessels under construction is 953,199 tons. The *motor tonnage* is thus nearly 91¼ per cent. of the *steam tonnage*. The tonnage of motor ships being built at the end of September in Great Britain and Ireland, 272,606 tons, amounted to 54·5 per cent. of the *steam tonnage* under construction. In Denmark, Holland, Italy and Sweden the motor tonnage under construction greatly exceeds the steam tonnage; the combined totals for these four countries being 112,700 tons of steamers and 411,808 tons of motor ships. The world figures include thirty-five motor ships, each of between 6000 and 10,000 tons; four of between 10,000 and 15,000 tons; three of between 15,000 and 24,000 tons; and one of about 33,000 tons.

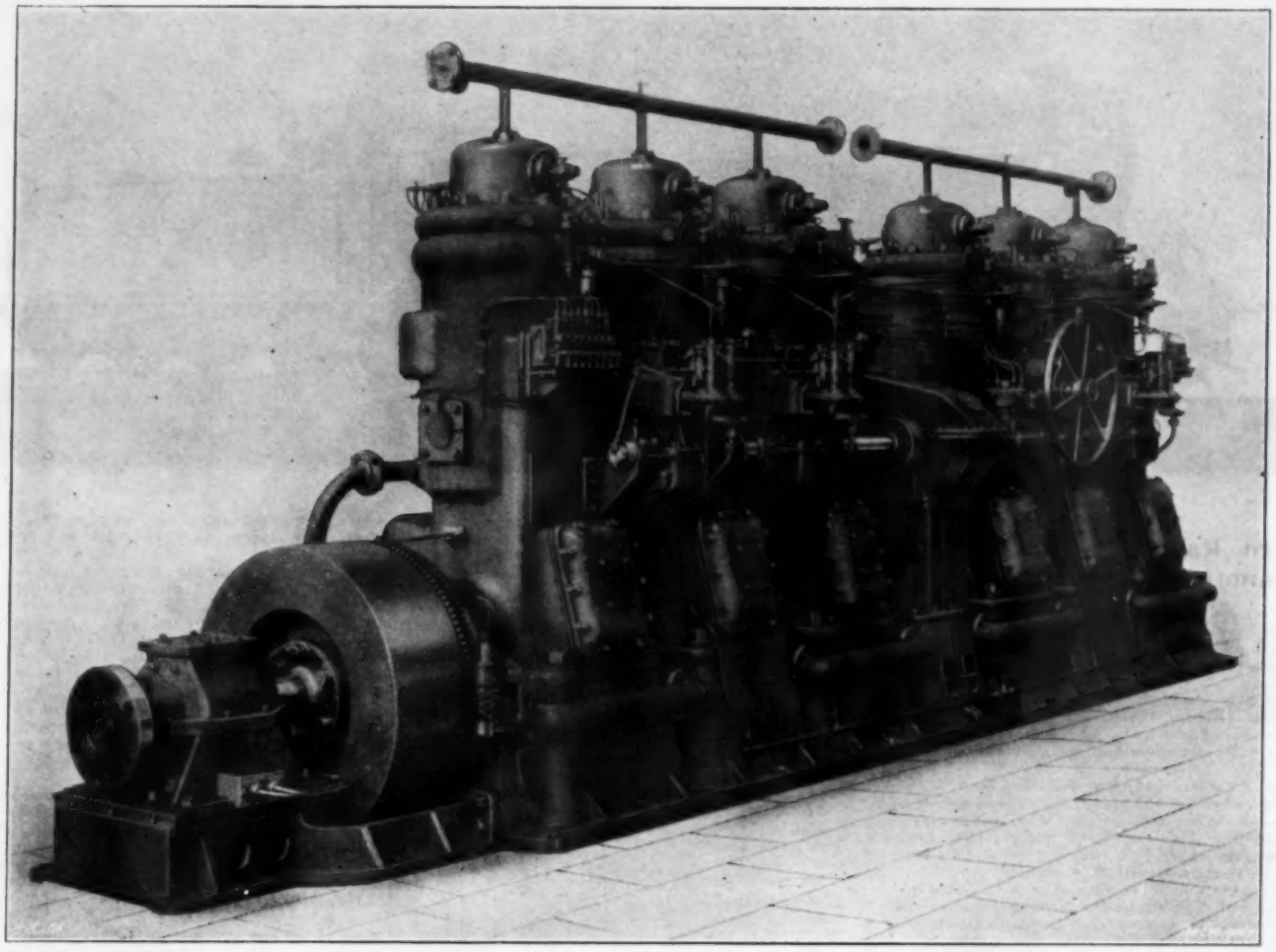

Working Pressure 220 Lbs. per Sq. in.
Water Capacity 5000 gallons
Coal 5 tons
13'9" Barrel
T. C. 21-11
T. C. 20-13
T. C. 20-13
T. C. 20-13
T. C. 20-6
T. C. 20-6
Total Weight on Coupled Wheels.....61 tons 19 cwt.
Total Weight of Engine in working order..83 " 10 "
" " " " Empty.....75 " 16 "
Total Weight of Engine & Tender in working order...140 tons 4 cwt.
" " " " " " Empty.....105 " 8 "
Total Weight of Tender in working order...56 tons 14 cwt.
" " " " Empty.....29 " 12 "
"The Engineer"
Swain Sc.

LEADING DIMENSIONS AND WEIGHTS OF "NELSON" CLASS EXPRESS PASSENGER ENGINES

Another table shows that the total horse-power of the engines being built or installed on board vessels at the end of September, 1926, amounted to 1,545,896 horse-power, of which 668,191 horse-power are being built or were built in Great Britain and Ireland; 181,160 horse-power in Italy; 121,900 horse-power in Germany; 119,370 horse-power in the United States; 117,530 horse-power in France; 108,740 horse-power in Holland; and 229,005 horse-power in other countries.

600 B.H.P. TWO-CYCLE MARINE OIL ENGINE

VICKERS-PETTERS, LTD., IPSWICH, ENGINEERS



Two-Cycle Marine Oil Engine.

On Tuesday, October 5th, we were present at the bench trials of the port engine—see above—of the 1200 shaft horse-power twin-screw motor tug Southland, which is being built for the Bluff Harbour Board of New Zealand, by the Dublin Dockyard Company (Vickers-Ireland, Ltd.). The engines are being constructed by Vickers-Petters, Ltd., of Ipswich, at which firm's works the trials referred to took place, prior to the first engine being shipped to Dublin for installation. The starboard engine is now well advanced, and it will be completed in a few weeks' time. When the Southland is launched it will, it is claimed, be the highest powered motor tug afloat. The following are the principal dimensions of the hull:—Length between perpendiculars, 135ft.; breadth moulded, 30ft.; depth moulded to main deck, 12ft. 6in.; mean draught, 12ft.; with a displacement of 694 tons. The two propellers are made of manganese bronze, and they were also supplied by Vickers-Petters, Ltd. They each have a diameter of 6ft. 4in., and are mounted on 6¾in. propeller shafts, with 6½in. diameter intermediate shafts. The engines and propellers have been designed to give the tug a speed of 12½ knots. In addition to the main engines the engine builders are also supplying the auxiliary machinery and lighting sets.

The Engine Design.—The two main engines are of the Vickers-Petters C86M marine type, and each is designed to give a normal output of 600 shaft horse-power when running at the designed speed of 270 revolutions per minute. The cylinders have a bore of 16½in., and the piston stroke is 18in. A feature of the engine is its low compression pressure—320 lb. per square inch—which gives a maximum combustion pressure of about 480 lb. It is not quite a year ago since the new "C" type of engine, with the cold cylinder head completely water-cooled, was exhibited at the Shipping, Engineering and Machinery Exhibition at Olympia. We described an auxiliary lighting set of this pattern in the special Exhibition Supplement which accompanied our issue of November 20th, 1925.

The engine with which we have to deal to-day is not only the first of its kind to be adopted for marine use, but it represents the largest size of engine of its particular type. The two-cycle principle on which it operates is clearly illustrated by the vertical section we reproduce in Fig. 1. On the upward stroke of the piston pure air is drawn through the automatic intake valves into the crank case. At the same time the air in the engine cylinder is compressed into the spherical combustion chamber above the working cylinder, until at the end of the pistons' upward stroke the temperature of the air so compressed is sufficiently high to ignite instantly the fuel oil injected mechanically, in the form of a fine spray, through the atomiser.

The combustion of the fuel so injected slightly increases the compression pressure in the working cylinder, and after being sustained for a short period, drives down the piston to perform its working stroke. The air in the crank case is then compressed to the low pressure of approximately 4 lb. per square inch, and when the exhaust and scavenge ports are uncovered by the piston, the burnt products of combustion are driven out and the cylinder refilled with fresh air for the new cycle. A characteristic indicator diagram, which was taken from No. 3 cylinder on October 6th, the day after the trial, is reproduced in Fig. 2.

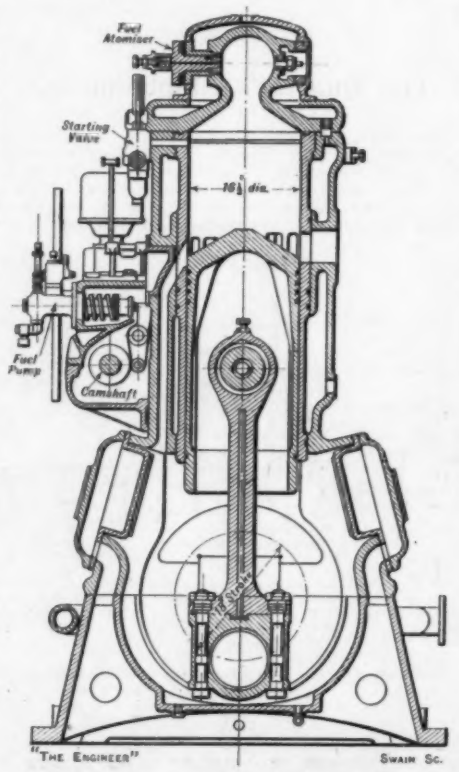


FIG. 1—VERTICAL SECTION OF ENGINE

A feature of the design already briefly touched upon is the completely water-cooled cylinder head, which is clearly indicated in drawing Fig. 1. That drawing also shows the robust character of the engine scantlings. From the general view it will be seen that an outboard thrust bearing of the Michell type is fitted, and that a fly-wheel with hand-turning gear is provided. It may be mentioned that the main bearings of the engine are water-cooled, and that the full supply of circulating water is taken through cooling jackets arranged under the bearings before it passes on to the cooling water spaces around the cylinders.

The fuel is mechanically injected and no compressed air is required for this purpose. Each cylinder has its own fuel pump. The fuel pumps are mounted on the front of the engine in pairs.

Reference may be made to the lubrication system. An overhead tank supplies the main bearings and other moving parts of the engine by gravity feed, while for the cylinder liners and pistons, mechanically-operated multipoint lubricators, which are mounted on the front of the engine, and are driven by excentrics on the cam shaft, are provided. Any excess of lubricating oil which may find its way to the crank case is pumped by a long stroke, slow-running pump back to the overhead tank, thus maintaining a constant oil circulation. By means of mask plates, which are fitted to the crank webs, the interior of the crank case is kept free from lubricating oil, so that no oil mixes with the scavenge air. The effectiveness of these provisions may be gauged by the makers' statement that the amount of lubricating oil consumed works out at 0·006 pint per brake horse-power per hour.

In engraving Fig. 3 we show the bilge and circulating pump unit, which includes also the lubricating oil pump already referred to, and the oil transfer pump, and is neatly arranged at the back of the engine. The pumps are link-driven, and run at one-third the speed of the crank shaft. Slow-running pumps have been chosen as being more likely to be reliable and efficient than pumps which are run at the full speed of the engine.

Manœuvring Controls.—The chief feature of interest in the engine we are describing is the special arrangement of the starting and manœuvring controls, which are so grouped that they can be worked by the simple rotation of a single hand wheel. The duties of the engine attendant when manipulating that wheel are facilitated by the control wheel nameplate shown in drawing Fig. 4. When the control hand wheel is rotated it operates the air starting and reversing gears, as well as varying the effective stroke of the fuel pumps and opening and shutting the cylinder relief valves.

These different operations are all performed quite automatically and in correct sequence, so that a movement of the control wheel to the right hand will cause the engine to run ahead, while movements to the left will cause it to run in an astern direction.

The different functions of the control wheel become more clear if they are dealt with under the separate headings of:—(*a*) Fuel control; (*b*) air starting; (*c*) reversing; (*d*) relief valve operation. Drawing Fig. 5 also serves to illustrate these different functions.

(*a*) *Fuel Control.*—The exact amount of fuel which is injected into the combustion space at each revolution of the engine is determined by the position of a scroll cam which is mounted on the top of the fuel pump. This cam controls the period of opening of a by-pass or spill valve arranged on the delivery side of the fuel pump. The scroll cam referred to may be seen on the end of

a horizontal shaft, which is placed at right angles to the main cam shaft, and is carried in brackets at the top of the fuel pump casing.

It is normally actuated by the governor, which works through a bell-crank lever—seen to the right-hand of Fig. 5—and a system of links. It will be seen that the bell-crank referred to is attached to a movable fulcrum, which is connected by a link to the control shaft, so that when the pointer attached to the control wheel indicates "stop" on the control wheel nameplate, the by-pass valves on the fuel pumps are held full open regardless of the position of the governor, and no fuel passes to the cylinders. Reference to drawing Fig. 5 will make the method of operation

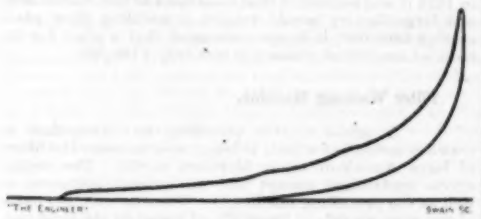


FIG. 2—TYPICAL INDICATOR DIAGRAM

clear. A crank pin on the end of the control wheel shaft is coupled to the fuel control lever, so that any movement of the hand wheel from the "stop" position in either an ahead or an astern direction causes a corresponding rotation of the scroll cams on the fuel pumps, and allows fuel to be injected into the cylinder during a portion of the fuel pump stroke. Any intermediate position of the control hand wheel between the "stop" and "full power" positions in either direction corresponds to an intermediate position of the scroll cams, and varies the amount of fuel delivered to the cylinders, enabling the speed of the engine to be regulated as desired between full speed and stop.

(*b*) *Air Starting.*—Starting air is supplied to each cylinder through a specially-balanced non-return control valve, which is mounted at the front of the engine on the cylinder jacket just below the cylinder head. The starting air control valves are opened by admitting pilot air to a cylinder and piston below the valve. The starting air valve spring is accessible, so that the working of the valve can at any time be tested. The pilot air cylinder tappet pressing on the valve stem destroys the balance of the

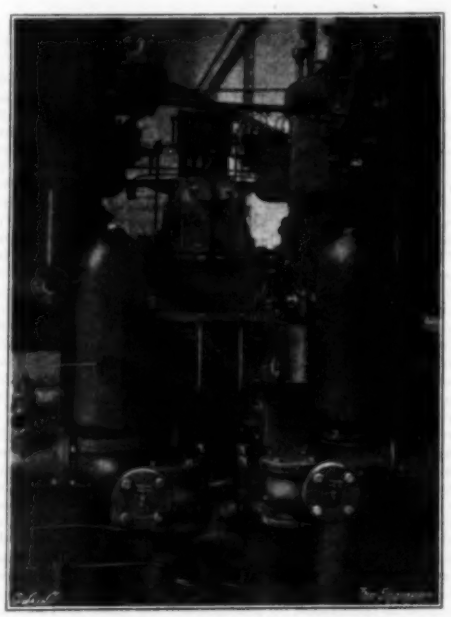


FIG. 3—BILGE AND CIRCULATING PUMP UNIT

main valve as soon as the pilot air is admitted. The pressure of the main air supply then opens the starting valve. The delivery of the pilot air is so timed that main starting air is given to each cylinder during the correct portion of its stroke. In designing the starting system a certain amount of overlap was provided for when fixing the period of opening of the various starting valves, so that the engine can start in any crank shaft position.

The pilot air supply is controlled by a series of small horizontal piston valves—one for each cylinder—which are arranged in the pilot air distributor casing just above the main cam shaft at the left-hand side of the control hand wheel. The piston valves are arranged in a ring and are operated by a single control ahead and astern cam. Air pressure is supplied to the back or outside of the valves and serves to hold them up against the cam tread. When any valve is pushed out by the cam the passage leading to the main valve on the corresponding cylinder is put into communication with the atmosphere. When, however, the piston valve travels radially inwards, the same passage is put into direct communication with the air supply and the pilot air reaching the small piston on the underside of the balanced control valve on the cylinder opens it as already explained.

On the control hand wheel shaft there are two cams which open the master valves on the main starting air supply system. The cams are arranged with different periods of opening, so that when the control hand wheel is moved beyond the "full power" position in either direction, one valve opens before the other. The opening of the first valve delivers air to the ¾in. main air rail, which feeds the balanced starting control valves on each cylinder, and it also supplies air to three only of the six pilot valves. The opening of the second valve supplies air to the remaining three pilot valves. The positions of the control hand wheel when one or two valves are open respectively correspond to the markings "3 on air" and "6 on air" on the nameplate illustrated in Fig. 4.

(*c*) *Reversing.*—From the accompanying drawing—Fig. 5—it will be seen that the master air valves and the fuel control lever are moved precisely in the same manner,

FIG. 4—CONTROL WHEEL NAME PLATE

whether the control hand wheel is moved in a clockwise or anti-clockwise direction from the central "stop" position. Reversing is accomplished in the following way:—A small pinion on the control shaft between the two cams which control the master valves gears in a two-to-one ratio with the reversing pinion on the reversing shaft. There is a link provided which couples a crank pin on the front of the reversing shaft to a lever on the pilot valve casing, which in turn actuates a tongue inside the casing in such a manner that it brings either the ahead or astern part of the cam into line with the pilot valves. A certain amount of lost motion between the movement of the tongue and the outside lever allows the control hand wheel to be moved in the ahead direction without interfering with the starting cams. When, however, the control wheel is turned in the astern direction, the pilot air cam is raised bodily, bringing the pilot valves into line with the lower part of the cam, which is timed to give an astern motion to the engine.

(*d*) *Relief Valve Operation.*—A spring-loaded cylinder relief valve is mounted on the top of each starting valve and an arrangement of links and rods illustrated at the top of the drawing—Fig. 5—enables the spring load to be released from all the six valves at one time by means of a master lever attached to the valve on No. 3 cylinder.

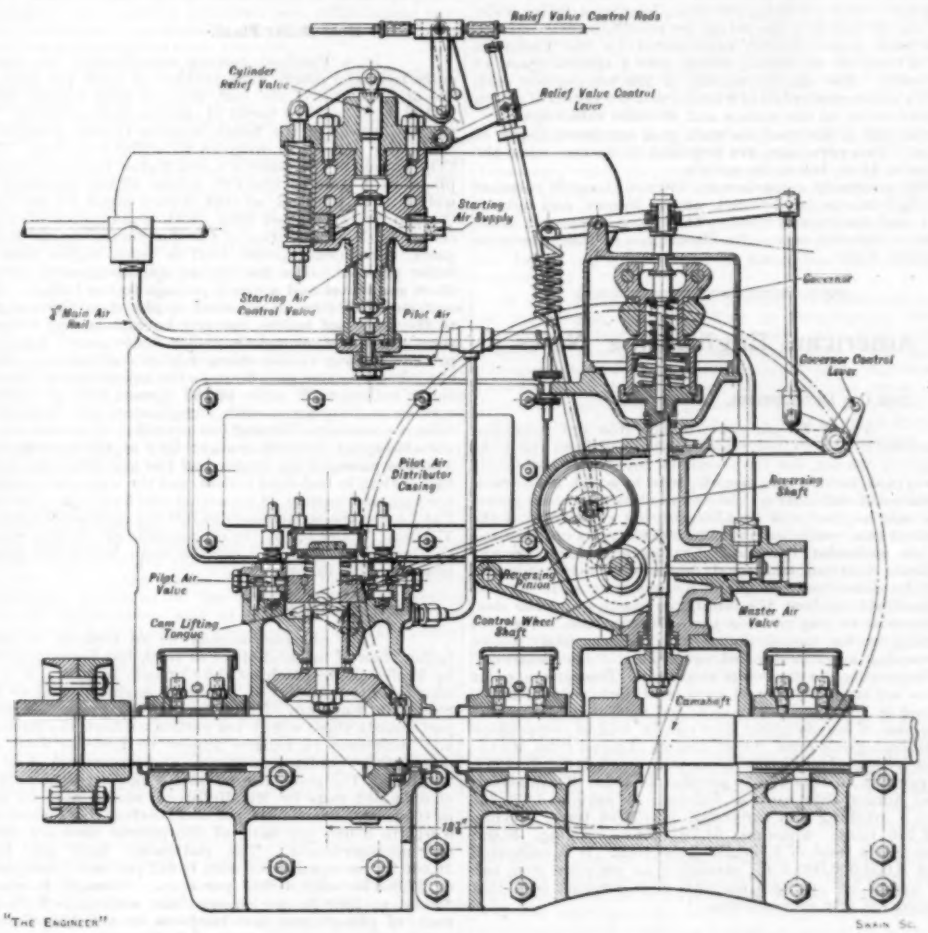


FIG. 5—ARRANGEMENT OF MANŒUVRING GEAR

The fuel control pin on the control hand wheel shaft has an extension in the form of a rod, the upper part of which passes through a yoke piece on the master lever just referred to. This rod has two collars pinned on to it in such a position that when the control hand wheel approaches the "stop" position all the cylinder relief valves are freed from their springs and the spring load is only re-applied just before starting air is admitted to the engine. By this provision there are no excessive pressures in the cylinders at the moment of reversal and the open relief valves tend to bring the engine more quickly to rest.

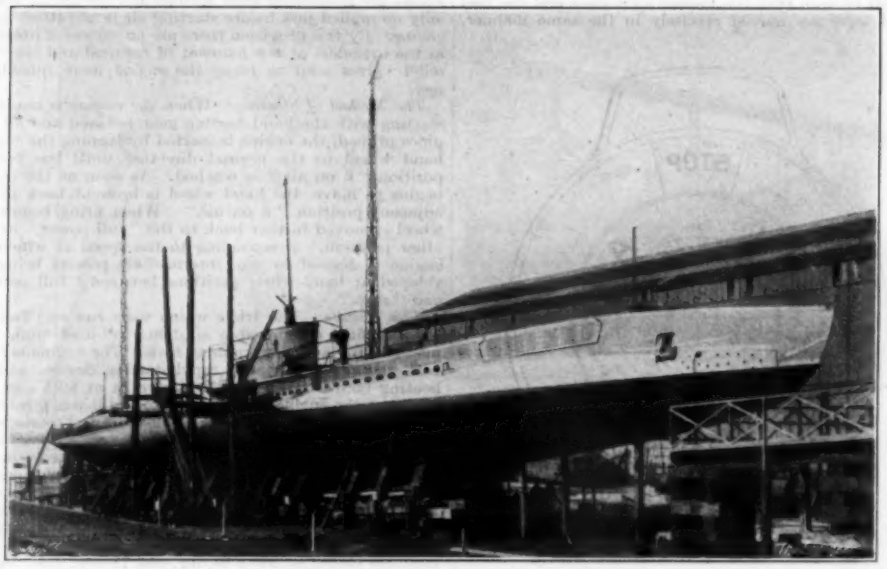
The Method of Starting.—When the engine is ready for starting with the hand barring gear released and all fuel pipes primed, the engine is started by turning the control hand wheel in the desired direction until the bottom position "6 on air" is reached. As soon as the engine begins to move the hand wheel is brought back to the adjacent position "3 on air." When firing begins the wheel is moved further back to the "full power," or any other position, corresponding to the speed at which the engine is desired to run, intermediate powers being developed at hand wheel positions between "full power" and "stop."

Test Results.—The trials which were run on Tuesday October 5th, comprised a six-hour full-load trial, with manœuvring and slow-running tests. The engine is fitted with the firm's patented rapid-starting device, and the heating lamps on the cylinder were lit at 8.24 a.m. At 8.27 a.m. the engine was started up, and it was put on full load at 8.30. The load was applied by a Froude water brake, and was kept constant over the six hours, during which the engine continued to develop its rated power of 600 brake horse-power at a speed of 270 revolutions per minute. The temperature of the circulating water entering the system was 55 deg. Fah. throughout the test, and the outlet temperature was 98 deg. Fah. at the beginning of the six-hour run and 115 deg. at its close. The shop temperature varied between 68 deg. and 71 deg. Fah. A fuel consumption trial was run between the hours of 9.10 a.m. and 12.10 p.m., during which three hours 786 lb. of fuel were used, corresponding to 262 lb. per hour or 0·437 lb. per brake horse-power hour. The time taken to bring the engine from full speed ahead to full speed astern was five seconds, and during the slow speed running test the engine was kept running at a speed of 65 revolutions per minute. The trials were completed at 4.30, after a short overload trial with the engine developing 660 brake horse-power at its normal speed had been successfully run. The trials referred to were witnessed by Lloyds and the Irish Free State Board of Trade officials.

INSTITUTION OF AUTOMOBILE ENGINEERS: GRADUATES PRIZE AND CROMPTON MEDAL.—Among the papers submitted for the Graduates' Prize awarded annually by the Council of the Institution of Automobile Engineers were two of such merit that the Council decided to augment the prize and award a first prize, both to Mr. E. W. Siaman, of the Birmingham Branch, for his paper on "The Straight-eight Engine," and to Mr. G. L. Ensor, of the Luton Branch, for his paper on "The Elements of Touring Car Engine Design." The Crompton Medal for the best paper read before the Institution during the past session has been awarded by the Council to Mr. W. Ferrier Brown, for his paper entitled "The Development of the Sleeve-valve Engine."

THE LATVIAN SUBMARINE SPIDOLA

CHANTIERS ET ATELIERS AUGUSTIN NORMAND, HAVRE, BUILDERS



Submarine for Latvia.

On October 6th the Latvian submarine Spidola was launched by the Chantiers et Ateliers Augustin Normand. The Spidola is a sister vessel to the Ronis, constructed at Nantes by the Ateliers et Chantiers de la Loire, to the plans of which both vessels were built. These submarines, which displace about 400 tons, are 55 m. long by 4·60 m. wide. On the surface they are driven by two Diesel-Sulzer-Loire 650 horse-power motors constructed by the Chantiers de la Loire at St. Denis, which give a surface speed of 14 knots. Two electric motors of 350 horse-power each give a submerged speed of 9 knots, and the radius of action is 1600 miles on the surface and 85 miles submerged.

The hull is designed to work at a maximum depth of 50 m. Two periscopes are provided to operate when the vessel is 11 m. below the surface.

The armament comprises six 450 mm. torpedo tubes, of which four can be directed, and a 76 mm. anti-aircraft gun and two quick-firers. Thirty-one men and three officers form the crew. An illustration of this submarine is given above.

American Engineering News.

Iron Ore Development.

About 85 per cent. of the iron ore consumed annually in the United States is obtained from the Lake Superior district, but the enormous deposits of high-grade ore in that district have been depleted to within measurable distance of exhaustion. In the next twenty-year period the consumption will be 1,060,000,000 gross tons, if the present rate continues, or 1,300,000,000 tons on the basis of an increasing demand. Extensive geologic surveys indicate that no additional deposits of high-grade ore will be discovered. For the low-grade ores, it appears unprofitable to both the mining companies and the steel companies to ship these in the ordinary state, except for mixing or for special purposes. There is likely to be increasing use therefore of methods of "beneficiating" or improving the ore before shipment. Thus at one point there are large deposits of loose sandy ores, which can be mined at low cost in open pits, and if treated by low-cost methods of beneficiation they can be sold in competition with high-grade ores. Of all the ore shipped from Minnesota mines, about 9 per cent. was beneficiated in 1914, 24 per cent. in 1924 and 35 per cent. in 1925. The methods used during 1924 were as follows:—Washing, 4,852,828 tons; crushing and screening, 2,375,016 tons; drying, 386,716 tons; sintering, 51,703 tons; jigging, 40,028 tons; or a total of 7,706,291 gross tons. It is estimated that 6,000,000,000 tons, averaging 35 per cent. iron, can be mined by open-pit methods and produce half that tonnage of iron concentrates.

Oil Engines for Pumping Oil.

One interesting but little-known branch of engineering which is very active in the United States is that of building and operating pipe lines from 50 to 500 miles in length for the delivery of oil from remote producing centres to the refineries. As the oil has to be pumped at intervals of 40 to 50 miles, this is an important field for the pump maker. Pipes of 6in. to 12in. diameter served by pumps of 20,000 to 40,000 barrels daily capacity at a pressure of 700 lb., are used. Engine capacity is about 15 horse-power per 1000 barrels daily pump capacity. Pump units range from a 3in. by 10in. duplex pump with 25 horse-power engine, to a large main line pump with an engine of 300 to 500 horse-power. Triple-expansion steam engines are still largely used and are economical with cheap coal, but where oil fuel is to be used, the oil engine gives higher fuel economy. Thus, while a steam engine will require 1½ lb. of oil fuel per hydraulic horse-power developed in the pump, the oil engine will give the same performance on ½ lb. of oil. Four-cycle horizontal single-cylinder oil engines of 100 to 300 horse-power, coupled to triplex pumps of 7000 barrels daily have been used, but the tendency is to much larger engines, up to about 750 horse-power. Herring-bone gears of about 1 to 5 ratio are used, with a flexible coupling on the pinion shaft between the engine and pump. The engines run at 30 to 40 revolutions. To provide for emergencies and repairs, it is usual to have a reserve or stand-by engine at each station, as the pumps work twenty-four hours a day continuously, the stations being operated by three crews on eight-hour shifts.

Waste Heat Boiler Plant.

In a Portland cement manufactory the waste gases from the rotary kilns contain 40 to 50 per cent. of the original heat of the coal, and the kilns require 90 lb. to 150 lb. of coal per barrel of cement clinker burned. In the new works of the South-Western Cement Company, the power plant was designed to utilise this heat. The CO_2 content of the gases is much higher than in a boiler plant, as it includes the CO_2 driven off the limestone as well as from the coal, so that it runs about 25 per cent. Oxygen averages 2 per cent., with a maximum of 5 per cent. As the evaporation of the slurry adds vapour to the gases, their mean specific heat is much higher than in boiler practice. The flue system was designed to give a short gas travel and a direct passage to the boilers. For uniformity of flow an equaliser is placed at right angles to the kilns and boilers, one end having the kiln connections and the other end the boiler connections. Dampers provide for any combination of kilns and boilers. From the kilns the gases pass down to the equaliser and then to three boilers, each with 10,480 square feet of heating surface and equipped with superheaters and horizontal tube economisers. Draught is provided by motor-driven variable-speed induced-draught fans at the economisers. The gas passages are longer and the gas velocities much higher than in fuel-fired boilers, and the waste heat boilers are high and narrow. Gases enter the boilers at 1250 deg. Fah., reach the economisers at 550 deg. and leave them at 375 deg. Water fed to the economisers at 180 deg. enters the boilers at 350 deg., and the steam leaves the superheaters at 225 lb. pressure.

Phosphorus in Steel.

That phosphorus may be an element of value rather than of harmful effect in steel, has been suggested by Professor McIntosh, of the Carnegie Institute, U.S.A., who cites the studies of American engineers and of Mr. Stead, in England. Thus, for certain grades of steel, particularly those with a low carbon content, the strength and resistance to fatigue appear to increase with the phosphorus content, without a proportional loss in ductility. The resistance to fatigue has been the subject of extended tests by Mr. McIntosh, and it appears that in steels of 0·09 to 0·11 per cent. carbon the presence of 0·012 to 0·085 per cent. of phosphorus does not affect the microstructure. The endurance limit ran from 26,000 lb. per square inch with 0·012 per cent. phosphorus to 32,000 lb. with 0·085 per cent. Strength increased 850 lb. to 1000 lb. per square inch with each 0·01 per cent. of phosphorus, and hardness on the Brinell scale had a corresponding increase of 2·75 points, while endurance increased 820 lb., all without a loss in ductility. It is concluded that instead of being regarded as an impurity phosphorus should be considered as an alloying element which is capable of giving valuable properties to steel, when used within certain limits of the chemical composition. Further investigations are to be made as to the influence of phosphorus in increased resistance to corrosion and in higher properties for welding.

Treatment of Industrial Wastes.

One of the problems of sewage treatment at Chicago, U.S.A., is that of the trade or industrial wastes. Three of the most serious of these, which in the aggregate are equivalent to the sewage from a population of 1,500,000, are the wastes from the cattle yards and meat-packing establishments, the tanneries and the corn products factories. Studies of the treatment of these wastes, which have been carried on for three or four years, included daily gauging of flow, analyses of individual and combined wastes, research as to their properties and peculiarities, and the operation of experimental treatment stations where various processes have been tried. It appears that meat-packing wastes can be treated to best advantage by the activated sludge process, which has advantages over trickling filters in lack of odour, ease of activation and small area required. Tannery wastes should have a sedimentation treatment at each tannery, the clarified effluent being then mixed with sewage for treatment. These wastes contain such germicides as free caustic lime, chronium salts and acids, thus interfering with bacterial action, but this effect is counteracted by large dilution with sewage. Study of the utilisation of corn products wastes by the manufacturers has developed by-products which greatly reduce the quantity of waste. Thus, while in 1924 it was estimated that treatment of the wastes from one large factory would require a trickling filter plant costing £600,000, it is now estimated that a plant for the reduced amount of waste will cost only £140,000.

Filter Washing Machine.

A petrol tractor travelling on caterpillars or crawlers instead of wheels is being used to clean the filters of large American water filtration works. The engine drives centrifugal pumps and mechanical agitators, as well as the propelling machinery. The machine, in charge of two men, travels in about 2ft. of water on the sand bed, stirs the surface sand and discharges it through a 3in. hose trailing behind the machine. Across the front of the machine is a box, 24in. square and 7½ft. long, open at the bottom, and having six vertical shafts, each fitted with a 12in. wheel having eight hollow teeth, which project into the sand. As the machine travels forward, water is pumped down the hollow shafts and wheels, escaping through the sand, and thus stirring it up, while the pump suction draws off this muddy water within the box. With ordinary conditions, one washing will handle 50 to 180 cubic yards of sand in an hour, and reduce the turbidity by 80 per cent., but a second washing may be required for extreme turbidity. The washer travels at speeds of 5ft. to 15ft. per minute, according to the penetration of the sand, and washes the filter bed to a depth of 12in. One man controls the speed of travel, water pressure, suction, speed of agitators and depth of pentration, while the other man handles the discharge hose, paying it out as the machine advances. Mud and bacteria are discharged with the water, while the clear sand is dropped by means of reduced agitation of the water in the upper part of the washing box.

BOOKS OF REFERENCE

Where to Buy Continental Iron and Steel. By Monsieur N. L. Stiernet, late of the Providence Steel Works, Marchienne au Pont, Belgium. Brussels: W. H. Smith and Son. Price 20s. or 5 dollars.—As a guide to intending purchasers of the products of the blast-furnaces and rolling mills of Belgium, Luxemburg and the Lorraine district of France, this little volume deserves genuine praise. The author has listed eighty-five of the most important iron and steel works in the territories mentioned, and has in each case given particulars of their principal products and of their rolling programme for the current year. This, by itself, would have been a most useful piece of work, but an even more important section of the book contains tables devoted to particular products, such as angles, channels, flats, joists, plates, rails, sheets, &c., each table giving the various makers of the different sizes of each product. The completeness with which this has been carried out is indicated by the fact that the index to this section alone contains no less than sixty-six entries. As every firm is designated by a number, the information is presented as compactly as possible. Turning over the pages at random, one notices that joists with unequal flange breadths are rolled at nine mills, and joists with excentric webs at three mills, and so on, the dimensions to which each mill will roll being designated in each case. Whatever kind of iron or steel product is wanted, by consulting this book the buyer can place the inquiry directly with the firms manufacturing it, without fear of receiving the too-common reply, "We regret that we are not makers of this class of goods." The task of British inquirers is even more facilitated by a mention of the name and address of the London agents of all firms possessing them. Tables of British and metric equivalents, length, area, weight per unit length, tensile strength, &c., also assist the British reader, although the dimensions of rolled sections are given in both systems of measurement. The book also contains a special section of thirty pages giving very useful information about the manufacture of plate glass, window glass, table glass, nails, bolts and nuts, enamelled ware and wire netting in Belgium. There is also a chapter on basic slag, with hints as to the quality and mode of packing necessary for the principal markets in the world. The book cannot fail to be as serviceable to Belgian exporters as to British importers of blast-furnace and rolling mill products, and one puts it down with a regret that the facilities of British firms engaged in iron and steel production are not as attractively and usefully tabulated for the convenience of foreign buyers.

The Ministry of Transport railway statistics for June, recently published as a Stationery Office publication—price 2s. 6d.—give the results for the first half of the present year, and indicate the serious results of the stoppage, since the end of April, in the coal industry. The number of passenger journeys, when compared with the first half of 1925, shows a decrease of 32·2 per cent., and the receipts from passengers one of 29·3 per cent. Passenger traffic of all kinds fell off 23·6 per cent. The tonnage of freight decreased by 57·5 per cent., the ton-miles by 45·4 per cent. and the freight receipts by 33·2 per cent. Some satisfaction may be found in the fact that this drop in the traffic was accompanied by a reduction of 38·3 per cent. in the passenger train miles and of 37·4 per cent. in the freight train miles.

Railway Matters.

PASSENGER trains between Paris and Orleans were hauled by electric locomotives for the first time last week. It is hoped that by the end of the year the new form of operation will reach Vierzon, 50 miles further south.

THE work is now in hand for making the junction towards Guildford at Leatherhead at the west end instead of at the east end of the station. When completed, the station on the Brighton section will also serve for the Guildford line, and allow the present South-Western station to be closed.

THE report by Colonel Sir John Pringle on the collision of July 8th between the down mail and a light engine at Brentwood and Warley, mentioned in this column of our issue of July 16th, assigns the responsibility for the mishap—which occurred during an early morning shifting mist—to a foreman who, finding that he had two engines to deal with instead of the usual one, failed to keep in touch and to inform the signalman of the movements he intended to make, and to the driver of the mail for lack of caution in running at a speed which the atmospheric conditions did not justify. Contributory factors were:—Very high signals without lower co-acting arms; an obsolete form of communication from distant points to the signal-box and the absence of emergency detonator placers. Automatic train control would, it is said, in all probability have prevented the accident. The unnecessary elevation of signal arms and lights is also commented upon.

A VERY pleasing incident occurred at Euston Station on Friday morning last on the arrival of the King and Queen from Scotland. Nine veteran retired engine-drivers who, during their from fifty to fifty-eight years' service with the London, Midland and Scottish Railway have driven Royal trains, were presented to their Majesties, who shook hands with and spoke to each one. As these men deserve to be on record in the pages of THE ENGINEER, we give their names, as follows:—Alfred Eachus, William Jefferies, William Hughes, Samuel Galley, John Tansley Hollins, John Ford, John Jones, Sampson Wright, and Alfred Elson. The men were afterwards entertained to breakfast at the Euston Hotel by the railway company, when Mr. J. H. Follows, the chief general superintendent, described them as a body of men of whom the nation had every reason to be proud. While there were interlocking systems and all kinds of safety appliances in use for the protection of travellers, the lives of all of them remained in the hands of the engine-driver.

IT was forty-five years yesterday—Thursday, October 14th—since, in a great gale, eighty-eight signals on the Midland Railway were blown down or thrown out of use. One signal so displaced was the up home signal at Desford Junction, Midland Railway. At that point entrance to an up loop was given by facing points, but the absence of the junction signal prevented an assurance being given to drivers as to whether the points were set for the main line or the loop. On the morning of a day a fortnight or so after the gale a mineral train had been admitted into the loop, but the signalman failed to restore the facing points before he permitted a passenger train to approach, and the latter ran into the loop and a fatal collision with the mineral train resulted. One consequence of the accident was a revision of those rules in the standard rule book which appertained to signalling. Flagmen were to be stationed to act, on the signalman's instructions, instead of the signal; the distant signals of the lines affected were to be disconnected—in the case in question the distant was pulled "off"—and entries as to what the defects were had to be made by the signal fitter in the train register book and countersigned by the signalman.

THE Railway Rates Tribunal has resumed its consideration of the standard charges that are to operate, under the Railways Act, 1921, from the "appointed day." Sir Ralph Wedgwood, chief general manager of the London and North-Eastern Railway, was the principal witness for the companies, and said that they had considered in particular the case of depressed trades, and had drawn up a scheme of concessions of rates below the proposed level of increase which they would be willing to apply after the appointed day. The industries immediately in mind were coal, iron, steel and agriculture, and they would absorb more than one-half of the 2½ millions that the companies expected to gain by the new rates. Other trades, though not so depressed as those named, needed relief and would still require favourable consideration. Sir Ralph thought that it would be better to discuss the question with the traders direct at meetings to be called. There was to be no increase in passenger ordinary fares, but those, such as tourist and week-end, at less than full rates, might possibly be advanced, but not by more than 10 per cent. A change would be made in season-ticket rates, whereby the charge for a long period would be proportionately less than for short periods. The advance in workmen's tickets would not exceed 1d. per day.

ON page 335 of our issue of September 24th mention was made of a connection that was being laid in at King's Cross between the Great Northern, Piccadilly and Brompton Tube Railway and that of the City and South London, to allow for the transfer of vehicles between the latter line and the Piccadilly to reach, or arrive from, the repair shops at Acton. We revert to that subject in order to say that the connection in question has not been sanctioned by Parliament but is being made under an Order of the Minister of Transport. Under Sec. (3) of the Ministry of Transport Act, 1919, power was given to make Orders for the acquisition of land and construction works, provided that the cost of the latter did not exceed £100,000. The authority was perpetuated under Sec. (17) of the Railways Act, 1921, and it is by such an Order that this tube connection is being built. The Board of Trade had somewhat similar powers, *e.g.*, under the Railway Construction Facilities Act, 1864, but those differed from the practice of to-day in that a report on what had been done under the powers had to be presented yearly to Parliament. No such return is now submitted; the only record is in the Statutory Rules and Orders. As a consequence the future historian of railways may have a difficulty in finding authority for the provision of certain works, such as this tube connection, should he wish to refer to their construction.

Notes and Memoranda.

A FLOOR formed of steel joists and a 2in. concrete slab was recently tested by fire at the Pittsburgh Testing Laboratory. It measured 6ft. by 10½ft., and was subjected to an oil fire having a temperature of about 1800 deg. for about 4½ hours. After cooling down again, it was found that the joists would still carry twice the design load.

A SHORT article in the *South African Mining and Engineering Journal* describes the rediscovery of the first boiler used on a Transvaal gold mine at Eersteling. It is of the Cornish type, and was put in service about 1875. It is, however, still in good condition, and possibly capable of reconditioning. The flues and stack are all built of stone.

A FIND of rich lode tin in Peppermint Hill, near Penguin, Tasmania, is reported. Samples have given returns up to 22 per cent. of the metal. An Ulverstone syndicate has secured a claim of 320 acres, and proposes to tunnel from the foot of the hill. Other claims have also been pegged, and are being prospected with satisfactory results, nuggety tin having been found.

SOME of the boilers at the Yallourn Power House, Victoria, have been equipped with step grates with the idea of increasing their output when burning brown coal. The boilers are rated at 70,000 lb. per hour, and previously only attained to 60,000 lb., but now evaporate 87,000 lb. per hour. On one occasion, in the step grate boiler, using a mixture of old and new cut coal, a maximum evaporation of 105,000 lb. is reported to have been obtained.

AN unusual mishap to a bascule bridge in America is mentioned in the *Engineering News-Record*. A sleeve on one of the hinge pins was put in upside down, with the result that lubrication was entirely stopped. The bridge, however, worked on the dry bearing ever since 1922. Recently, however, vibrations developed in the compression members, and the trouble was discovered. The pin could not be driven out and had to be cut away piecemeal to put matters right.

IN May last, says *British Industries*, a Glasgow firm sent one of its electrically-driven jigger conveyor gears to an exhibition held in connection with the Mining Congress at Cincinnati, Ohio. Notwithstanding the barrier of the high American tariff, this firm believed its product to be so far in advance of anything produced in that country that good business would result. This belief was fully justified; the machine exhibited was immediately sold, and orders for a considerable number of these conveyors are now being received from America.

IT is now agreed by almost all chemists, engine makers and users, states Dr. Dunstan, that sulphur has no disadvantages in a Diesel or semi-Diesel fuel. This is obviously the case, since the products of combustion are gases inert to metals, and the only possibility of corrosion is at the cool end of a long exhaust pipe where the steam resulting from combustion might condense into water and dissolve the oxides of sulphur. It was with the intention of indicating its opinion that sulphur is innocuous that the B.E.S.A. Committee agreed to insert no limitation to sulphur content in its specifications.

MACHINERY, all kinds, and including belting, which previously ranked second in order of importance in the import trade of India, now takes third place, and gives way to cotton yarns and metals, states Mr. W. D. Montgomery Clarke, H.M. Trade Commissioner at Calcutta, although during the last fiscal year there was an increase of Rs. 14½ lakhs to over Rs. 14¾ crores in the total imports of machinery and millwork. (This does not include belting.) The depression in the cotton spinning and manufacturing industry was still reflected by a further reduction of imports of cotton mill machinery by Rs. 32½ lakhs, notwithstanding the abolition of the cotton excise duty.

ACCORDING to the *Anglo-Norwegian Trade Journal*, the Norwegian aluminium industry consumes about 120,000 horse-power per annum, and produces annually about 25,000 tons, of which the greater part is exported. The industry will in the course of the next few years receive important additions as the waterfalls at Kinsarvik—116,000 horse-power—and at Glomfjord—75,000 horse-power—will be used for aluminium production. The annual production of aluminium will thereby be increased by upwards of 40,000 tons, *i.e.*, will be much more than doubled. Up to a few years ago the whole of the aluminium produced in Norway was exported. In 1917, however, the first works for the production of kitchen utensils and other articles was constructed, and since then several other works specialising in the various uses of aluminium have been erected. During recent years the export surplus of aluminium has amounted to about 20,000 tons per annum, of a value of between 55 and 60 million kroner. With an increase in production of about 40,000 tons the export value is likely to surpass 100 million kroner and may reach as much as 150 millions.

AT one time it was believed that spontaneous combustion in coal mines was due solely to the heat generated by the oxidation of iron pyrites present in the coal, and, while modern research has shown that the phenomenon is most often traceable directly to the oxidation of the coal substance by the air, there seems little doubt that the presence of pyrites may sometimes be a contributory or even a determining factor. An account of an examination of the various types of pyrites occurring in coal with a view to determining their composition and to identifying those types which oxidise rapidly is contained in a paper entitled "Pyritic Oxidation in Relation to the Spontaneous Combustion of Coal," by H. Macpherson, N. Simpkin and S. V. Wild, of the research staff of the Lancashire and Cheshire Coal Research Association. (Safety in Mines Research Board Paper No. 26, H.M. Stationery Office, Adastral House, Kingsway, London. Price 1s. net.) A laboratory study has been made of the rates at which varieties of pyritic material oxidise and of the character of the products formed, and the results have been correlated with observations on the behaviour of the material *in situ* in the mine. The results emphasise the importance that must be attached to the mode of existence of pyrites when considering its probable influence on the spontaneous combustion of coal.

Miscellanea.

THE new cold storage plant of the Durban Municipality is being supplied by L. Sterne and Co., at a cost of £10,038.

IT is probable that the Diesel-driven power station at Umtata will be abandoned in favour of a local water power scheme.

A GASWORKS with a capacity of a million cubic feet per twenty-four hours is to be put up in Johannesburg, at a cost of £220,000.

THE works of the British Aluminium Company at Vigeland, Norway, are to be extended to produce over 4000 tons of aluminium a year.

AN experimental paper mill, to cost between £20,000 and £30,000, is to be put up in the Huon District of Tasmania, to use the local timber.

A NEW synthetic ammonia works, with a capacity of 30,000 tons of sulphate annually, is to be put up in Japan by the Japan Artificial Manure Company.

A DISTILLERY for producing power alcohol is to be put up at Cairns, Queensland. It is to have a capacity of from 800,000 to 1,000,000 gallons annually. When these works are completed another distillery is to be erected at Townsville.

AMONG the new factories being erected in South Africa there are a briquette works, in Johannesburg, with a capacity of 400 tons a day, and a superphosphate plant at Somerset West. The latter works will bring up the output of the Cape Explosives Company to 60,000 tons a year.

SOME recommendations have been made to the Victorian Electricity Commission, by Herr J. Klitzing, concerning the mining of the brown coal at Yallourn. He advises the purchase of a German "dredger" and other plant at a cost of £486,000 and the extension of the briquetting plant to a capacity of 1,000,000 tons a year.

THE Municipality of Upington, South Africa, is contemplating a combined water and electricity scheme, expected to cost about £15,000. Mr. Adendorf, of Capetown, has been asked to submit a report. The S.A.R. Administration and the Imperial Cold Storage Company have agreed to support the undertaking.

IT would appear, from a communication we have received from Sir Robert Gower, that there is an impression abroad that participation in the British Industries Fair, which is to be held at the end of February next, is possible only for firms with large financial backing. Such, however, is not the case, and a stand may be secured for as little as £20, and its rental includes the privileges of a very extensive advertising scheme.

APPLICATION has been made to the Canadian Parliament for a charter incorporating the Niagara Memorial Bridge Company, which proposes to erect a new bridge over the Niagara River, at a point between the present International bridge and Niagara Falls. The structure will be 70ft. wide as compared with the present 45ft. dimension of the upper bridge. The application for a charter has been made on behalf of a syndicate of Canadian and American capitalists.

IN view of the continuous demand for additional space at the British Industries Fair in Birmingham—where the heavy industries of the country make their annual display of new products—the Birmingham Chamber of Commerce has now found it necessary to make still further extensions to the Exhibition buildings, and plans have just been passed for the immediate enlargement of all the three main buildings, at a structural cost of about £30,000. The dimensions of the further building, as enlarged, will be 620ft. by 225ft.

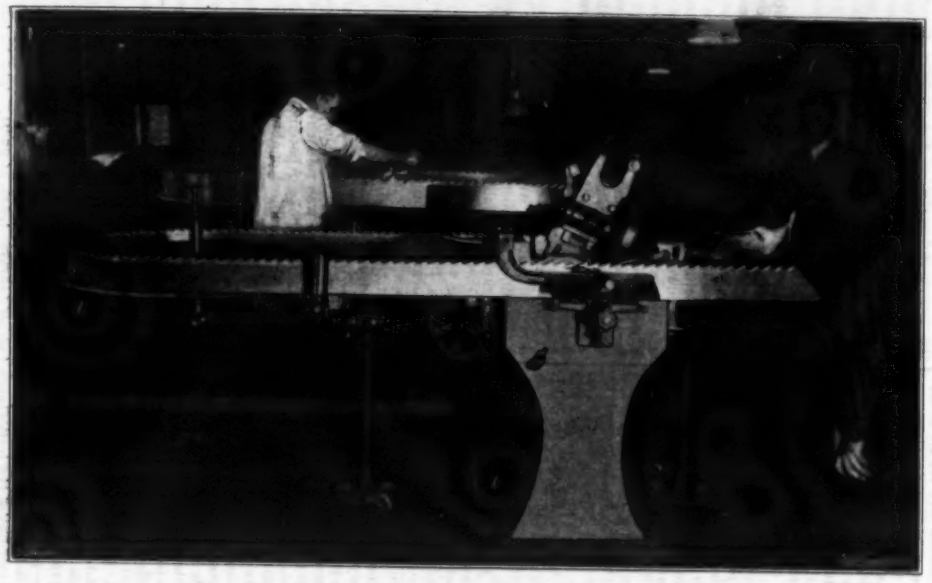
A NEW hydro-electric installation embodying points of interest has just been finished by the Sociedad Hidraulica de Sumbilla to utilise the water power of the river Bidasoa, in the Province of Navarra, where, under a head of about 125ft., energy is available to the extent of 3200 horse-power. The feature of the installation is that the water power is utilised in two adjacent but distinct plants, one being equipped with two 800 horse-power Escher-Wyss turbines and Siemens generators and the other with two groups consisting of Charmilles (Geneva) turbines and Swedish General Electric alternators of the same power. The power from both plants is to be transmitted to San Sebastian.

THE Smoke Abatement League of this country is getting down to bedrock work by arranging for local voluntary associations to investigate conditions in their own districts, with regard to possible abatement of smoke. The intention, states *World Power*, is to increase interest in this ideal by bringing together industrial users of coal and scientific research bodies with a view to educative propaganda. The education should be beneficial not only to scientific industries and to research workers, but especially to ignorant propagandists who clamour for legislation without realising what is involved for certain industries. It will also promote more serious consideration of possible improvements of several industrial processes by scientific means. Action was taken to strengthen the forthcoming Government Smoke Abatement Bill with a view to removing certain objectionable features of the Bill.

ALTHOUGH a number of brown coal deposits in South Australia have been proved by boring to contain considerable tonnages, so far no deposit has, according to the *Mining Review*, been found sufficiently near the surface for open cut mining. In giving evidence before a Parliamentary Commission, Mr. John L. Pearson, inspector of mines, reviewed the work that had been done on the various deposits. The three fields which had so far disclosed reserves of commercial significance were Moorlands, Inkerman, and Clinton. At Moorlands the average thickness of the main seam was 14·8ft., and the average depth 29ft. The ratio of overburden to coal was 5 to 1. At Inkerman the main seam was 21ft. thick, at an average depth of 242ft. At Clinton the main seam is 21ft. thick, at an average depth of 292ft. The estimated cost of producing coal with coal cutters and mechanical loaders was 9s. 6d. per ton at Moorlands and 10s. 6d. at Clinton and Inkerman.

SAW DOCTORS' SCHOOL OF INSTRUCTION, SHEFFIELD

(For description see page 421)



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DEATH.

On October 9th, Mr. Augustine Bond, managing director of the Cambrian Wagon Company, Ltd., of Cardiff.

THE ENGINEER.

OCTOBER 15, 1926.

A New Express Locomotive.

The appearance of a new locomotive on British railways always compels comparisons with those that have preceded it. There is nothing invidious in such an analysis of respective merits, for steam locomotive design is progressive, and each new arrangement should embody all that may be learnt from those which have gone before it. Moreover, a great railway problem is being tackled at the present time, and every new engine makes therefore a special appeal. That problem revolves about the number of cylinders. The two-cylinder engine for heavy express work is passing; it cannot satisfy modern requirements. Three or four cylinders must be employed, and the question which is the better arrangement can only be answered by direct experiment. The three-cylinder engine had been long familiar on the North-Eastern Railway, but since Mr. Gresley developed his design with a combined valve gear, the type has attracted a great deal of attention, both at home and abroad. Yet whilst the excellence of the work performed on the North-Eastern Railway by these engines cannot be gainsaid, the four-cylinder engine has always had stalwart advocates. Mr. Collett has shown his firm belief in it for express work in his "Castle" class, and now in its latest engine, the Lord Nelson, we find the Southern Railway perpetuating it after a trial of the three-cylinder type in a group of 2–6–0 engines, and it is rumoured that another great railway also will before long place a new four-cylinder locomotive on the rails.

Mr. Maunsell's new engine, of which we reproduce a photograph and weight diagram on another page, is a notable addition to the Southern stock. It is designed to haul 500-ton express trains at an average speed of 55 miles per hour. Its weight is 83 tons 10 cwt., and the load on the coupled axles is substantially over 20 tons; actually, 20 tons 13 cwt., which, we believe, is the highest figure for express engines in this country, but is still far behind that used in America. Complete with an eight-wheeled tender, it weighs 140 tons 4 cwt. Contrasting engines only, it is heavier than the Great Western "Castles" by 3 tons 13 cwt., but lighter than the Flying Scotsman by nearly 10 tons. The grate area of 33 square feet falls between that of Mr. Gresley's and Mr. Collett's engines. It raises a particularly interesting point to which Mr. Maunsell has devoted much attention. The ordinary two-cylinder arrangement with cranks at right angles gives four blasts per revolution; the three-cylinder arrangement with cranks at 120 deg. gives six blasts. The four-cylinder arrangement with opposed cranks also gives four blasts per revolution. But by so placing the cranks that the angle between one pair and the other pair is 45 deg., eight blasts per revolution are given. Moreover, for a given tractive effort the four cylinders are smaller than either the three or the two, and than two together as in the ordinary four-cylinder arrangement. Hence, the total effect is that instead of four heavy blasts or six moderate blasts, eight small blasts are given. There can no longer be any doubt that increase in the regularity of the draught has a greater effect upon fire-box efficiency than was anticipated. Whether it is due only to a better condition of the fire, which is not torn into holes, or to the fact that less small coal is drawn unconsumed through the tubes, it is now established that a better rate of evaporation per pound of coal is secured when a fierce impulsive draught is replaced by an almost steady pull. From observation of the Lord Nelson on the road, we can say that she runs with notable quietness, and we are told that she steams with unexpected ease. But there is an obvious objection to the particular crank arrangement which Mr. Maunsell has adopted to get this even draught. The engine is obviously not in such perfect balance as when the cranks are set at 180 deg. There must in consequence be some hammer blow on the rails, and we await with impatience particulars as to its amount; but whilst we cannot see how it can fail to be higher than in the Great Western four-cylinder engines, it will be less than in the normal two-cylinder engines, and we suspect will prove to be of an immaterial amount. It will be of interest to see how the torque with this arrangement compares with that of the three-cylinder and normal four-cylinder arrangement. In another important respect Mr. Maunsell's engine is noteworthy. Many of our readers will recall that when Mr. Gresley's paper on "Three-cylinder Locomotives" was read at the Newcastle meeting of the Institution of Mechanical Engineers in 1925, the question of independent *versus* combined valve gear was discussed. There has been in general a reluctance to add valve gears, and various devices have been produced for operating three or four valves with only two sets of gear. Mr. Maunsell, however, has put in four separate sets, all Walschaerts, both inside and out, all operated simultaneously. It is, indeed, difficult to see how he could have done otherwise with his crank pin arrangement, but we believe that, like Sir Vincent Raven, he prefers in any case independent gear, as by it lost motion, which is always a possibility to be faced in rocking shafts, though we understand that Mr. Gresley has quite overcome it by close attention to details, is obviated. We should add that by using special grades of steel, the four motions have been kept exceptionally light, and are easily operated by hand.

We are inclined to deprecate somewhat the claim, usually made by railway publicity departments rather than by engineers, that a particular engine is the most powerful because it has the highest tractive effort. "Tractive effort" is a very useful figure—within its limitations. It is measured when an engine is just moving with a load, and may be modified greatly by small changes; but accepting it as a basis, then Mr. Maunsell's express engine is the most powerful in Great Britain, for with 85 per cent. of the boiler pressure—which is 220 lb.—it amounts to 14·96 tons, as compared with 14·12 of the "Castles" and 13·32 of the L.N.E.R. "Pacifics." It must be noted, however, that the engine has only 6ft. 7in. wheels, as compared with the 6ft. 8½in. of the Great Western engines and the 6ft. 8in. of the North-Eastern engines. The pressure, moreover, is but little lower than the 225 lb. of the "Castles," but materially higher than the 180 lb. of the Flying Scotsman. After all is said and done, the power of a locomotive resides in its boiler. If that is not big enough to supply all the steam required, then no matter what the tractive effort may be, the engine cannot claim priority. In the case of the Lord Nelson, there appears to be no question whatever about the ability of the boiler to supply easily all the steam that is required, and we take that admirable result to be due to the steady draught which is given by the four cylinders and the crank pin arrangement adopted. There can be little doubt that Mr. Maunsell has considerably bettered his own two-cylinder "King Arthurs" in this new class. The Lord Nelson weighs but little more, yet shows a tractive effort of nearly 15 tons, as

against 11·3 tons of the "King Arthurs." He is to be heartily congratulated on the design, which we understand is to form the basis of a class of "Admirals."

New Materials and Old Methods.

THERE are probably few, if any, among those concerned with engineering or metallurgy who do not, in theory at least, welcome the idea of progress in their industries. Engineers, for example, would be only too ready to utilise the advantageous properties of new materials of construction and metallurgical manufacturers would be no less glad to provide such materials. They look, naturally enough, to the results of research to provide them with the means of making such materials and of utilising them to the best advantage. Yet there is undeniably a very serious lag between the moment when the results of a research embodying an important advance are published and the time when they are made available industrially. There are, of course, a number of well-known causes at work in producing this delay, such as the recognised difficulty of passing from research result to industrial production on a large and economic scale. Such difficulties, however, exist everywhere, and yet this lag appears to be much greater in this country than it is, for instance, in America or Germany. What is the reason?

We cannot accept the suggestion sometimes made that the delay or even the failure to utilise research results is due to any real lack of enterprise or energy on the part of our manufacturers. The record of British achievement in the past is altogether too fine to afford room for that view, although the record of discoveries made by British investigators, but first exploited elsewhere is also significantly large. The failure to take rapid advantage of research results must be ascribed to other causes, and we would suggest that it is intimately connected with the attitude of mind with which too many British manufacturers still regard research and its products. There is, in the first place, a deep-rooted distrust of the results of laboratory investigations, even when they have been carried out by men of admitted competence and in laboratories equipped on an adequate scale. This is based upon the feeling that, somehow, laboratory work is not "practical," and that while anything discovered more or less accidentally during works practice is likely to be useful and reliable, that which is discovered or done in the laboratory "cannot be done in practice." However unfortunate such a mental attitude may be in its results upon industry, it must be admitted that there is, from one point of view, some justification for it. In the first place, there is a certain amount of so-called research that does not deserve the full confidence of practical men. Work is often done on much too small a scale, inadequately substantiated owing to lack of time or means, or carried out by youthful student investigators whose work is unwisely published. Unfortunately, such work is too frequently presented to the technical world side by side with the results of serious and important investigations, and, unless the grain is sifted from the chaff by acute and searching criticism in verbal discussions or in the Press, it is difficult for the practical man to distinguish between that which he should hasten to utilise and that which he had better ignore. Severe criticism of work published by young investigators, however, is often deprecated on the ground that it may cause undue discouragement, while, on the other hand, even the best and most reliable work is sometimes subjected to unjustified attack. To that extent, therefore, we must sympathise with the attitude of reserve which is encountered among practical men unless or until they can be given entirely convincing proofs or demonstrations. Even when these are given, however, there is by no means always a due readiness to adopt or even to try a new material or a new process, and it is here that we come upon the particular aspect of the matter with which we wish to deal. The objections which are raised, and which are allowed to stand in the way of progressive adoption of research results are often heard in the form of remarks to the effect that the new thing is "too complicated" or "too difficult," that it is "not adapted to works conditions," &c. Sometimes, the matter is put more directly, when it is definitely demanded that a new and improved material for a given purpose should be produced, but with the condition that it must not be more difficult to produce than the existing article. This, we fear, is the demand for "something for nothing," very thinly disguised. It amounts, in many cases, to demanding that something new and better shall be produced by the old and imperfect methods formerly employed, and it is this demand which only too often bars the way to real progress, which is left to be achieved elsewhere. It is, of course, perfectly true that in a large number of cases existing works methods are unsuited for the production or treatment of a new material or the application of a new process, and that therefore the development of the new thing is fraught with difficulty and expense. British manufacturers are, we fear, inclined to blame the research worker for this state of affairs and to call him "unpractical," when his work leads him into new and hitherto unused paths. Yet, if we view the matter rightly, it is clear that this is an inevitable condition of progress. A certain limited degree of progress can, in some cases, be achieved by what may be called detail improvements of existing processes or materials, and we fear that it is often to these that the "research" aspirations of the practical man are confined, although, of course, there have been and are bold inventors and discoverers to be found in the works as well as in the laboratories. Wherever they originate, however, the really important forward steps in industrial progress have always entailed a serious and sometimes a radical departure from previous practice. Often enough, such forward steps have entailed the scrapping of plant and the adoption of entirely new manufacturing methods. There is a natural reluctance to face a step of this kind, and there are also serious material difficulties to be encountered, so that reluctance can be readily understood. The difficulty is, however, that if the new thing is "turned down" or left to wait too long, it is apt to be developed into practical reality abroad and our manufacturers are then placed in a still more serious position.

The decision in each particular case, whether it is or is not worth while for an individual manufacturer or for an industry co-operatively to take up some new discovery or invention, must, of course, be left to those who have to find the means, both material and human, for the attempt to put the new thing into practice. All we wish to plead is that they should not expect "something for nothing"; that they cannot expect to produce new and better things by the same methods and with, at first, quite the same ease as the older products to which they have become accustomed and adapted by years of practice. Where it is said that a new thing is not suited to works conditions, the fact is often simply that it is necessary to create or develop new conditions in the works in order to take advantage of the forward step which is offered by research. It is not always true that what can be done in the laboratory to-day can be done in the works in the near future; but, in fact, this has been the history of many industries, so much so that it is dangerous for a manufacturer, and still more for an entire industry, to be content with a *non possumus* attitude where new possibilities are concerned. Vision is required to see the future industrial possibilities of what may appear a difficult laboratory experiment, but it is upon such vision that great and progressive industries are founded and maintained.

Motor Cars in Paris.

(*By our own Correspondent.*)

THE Salon de l'Automobile was not held last year because the Grand Palais was occupied by another exhibition, and the organising committee did not think that any other building was sufficiently suitable for the purpose. After a lapse of two years, therefore, it was expected that the French automobile industry would show striking developments, but the Salon conveyed an impression that while there is an appreciable advance in the way of refinement of details, there is no departure from the general principles which guided makers two years ago. At that time attention was centred more particularly upon light engines of high angular velocities. Since then the behaviour of those engines has been watched with interest, for obviously there is nothing to be gained in producing a light and small engine if its life is to be shortened by excessive wear and tear. Apart from the question of lightness, the main object in running engines at very high speeds was to create types of small nominal horse-power for the purpose of taxation and yet provide motorists with as much power as they required. A six-cylinder engine of 1500 c.c., for example, is declared for 6 horse-power and is yet capable of developing 130 horse-power. Some people have an idea that this is carrying the propensity to evade taxation to an extreme. There will always be a fairly large class of motorists who are attracted by the small high-speed engine with rapid acceleration, and there is no doubt that this type of engine will continue to be developed until it reaches a point where it will permanently influence the design and construction of motors suitable for the ordinary user. The 1½-litre engine, which will give more than 100 horse-power, is a remarkable achievement of the motor builder, and many engines now made are wonderful examples of what can be done nowadays in a specialised branch of engineering. Nevertheless, while admiring these products of the motor engineer, the average automobilist is still sceptical regarding their durability and economy. There is a decided tendency to attach more importance to the solidity and efficiency of a motor than to its weight, and in the Paris Show the engines were mostly of the 1½ to 2-litre class, with everything simplified and rendered as compact as possible. The single power unit is still in favour, and there appear to be fewer cars in which the engine and gear-box are separate. Overhead valves are becoming more general on account of the higher speeds at which the engines are run, and they also have an advantage in giving a cleaner appearance to the engine, which, externally, is characterised by severe simplicity. The four-cylinder engine is still predominant, but the desire for flexibility is giving more importance to six-cylinder and even to eight-cylinder engines, which are either straight or V-shaped. There is no new departure in the engines themselves. The improvements are to be seen almost entirely in points of detail.

In the chassis there is the same absence of any real novelty. Attempts are made to improve design by compromise, and more attention is given to such details as suspensions, steering gears, and brakes. The keynote of the situation is comfort and security. In the Sizaire the original spring suspension of wheels has been developed in an interesting manner, and this indicates possibilities of departure from standard practice in other directions which may lead to progress in the future. Makers have, obviously, in no way reached finality, because any radical changes can only be made with extreme prudence, and any attempt to perfect and introduce them is checked by commercial considerations. Moreover, improvements are usually costly and have to be embodied in car design when the public requires them, such as, for example, the four-wheel brakes, but there are other improvements of a valuable character which can only be adapted to expensive cars. The Farman car has a new system of steering gear with conical worms, which ensures remarkable ease and security in steering. It may be remarked also that while endeavouring to simplify design the French maker has not found it prudent to sacrifice either material or workmanship on the score of price, and the tendency that was observable two or three years ago towards the production of cheap cars has not materialised, except, of course, in the case of a few firms who specialise in the mass production of popular cars. Even these have, for the most part, found that the cheap car has only a temporary popularity, and those makers who have not gone out of the business are increasing the powers and sizes of their chassis because they find that it costs comparatively little more to build a higher-powered car which can be sold for a higher price. The small cheap cars are not profitable to the maker nor, generally, to the user. There are, nevertheless, a number of small firms who continue to turn out light and cheap chassis.

In a general way the prices of French cars are advancing irrespective of the difference in currency values, and it is fairly certain that this advance will continue. This is one of the reasons why it is found necessary to give more attention to the quality of the cars than to the price. There is a less urgent appeal to the ordinary user than formerly. It seems easier even to sell a good car at a good price than to dispose of cheaper vehicles. The same thing is noticeable in the carriage bodies, which are often more luxurious than formerly, and the policy of French builders is obviously to present attractive and reliable vehicles at prices below those of their foreign competitors if possible, although in this respect the situation raises a note of inquiry which is not altogether reassuring to the French manufacturer.

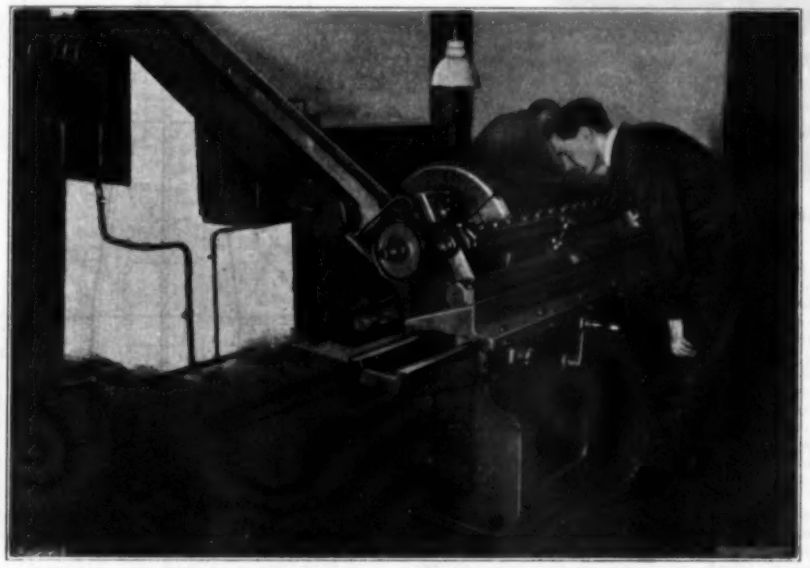
A disturbing element in the outlook is, indeed, the number of American firms which exhibited at the Paris Show. For a long while past a threat of American competition has been in the air, first over the invasion of Ford cars, which were to have been manufactured in different parts of the Continent, and although the number of such cars in service has noticeably increased, it cannot be said that the invasion has so far actually threatened the home industry. It may, nevertheless, be partly responsible for the falling-off in the production of cheap vehicles. So far as the higher-priced cars are concerned, French makers did not expect to find themselves in direct competition with the Americans, and in the French market it is hardly conceivable that, with the almost prohibitive import duties, there will be any large importation from the United States. Still, the fact of so many American makers exhibiting in the Grand Palais shows that they are pursuing a definite policy which clearly aims at making use of the Paris Show as a means of doing business in some of the European markets and also, curiously enough, in South America. Visitors to the Grand Palais were distinctly cosmopolitan in character. They came from all countries, and there is no doubt that on account of its situation Paris is increasing in importance as an automobile business centre. There is a floating population of wealthy South Americans in Paris whose custom is valuable.

The prices of the higher-class American cars exhibited in the Grand Palais appeared to be prohibitive, but amongst a healthy foreign class that is almost an incentive to purchase. In any case leading French makers feel that they will have to take American competition into account very seriously in the future.

The Making of the Modern "Saw Doctor."

In the past the "Saw Doctor," as we call him to-day, but the "saw fettler" or "tool smith" or "sharpener," as we knew him in years gone by, usually absorbed his learning in a very haphazard manner. As a rule the craft of tool maintenance was handed down from father to son for several generations, and in any case the tyro had to rely on the experience of the men around him and very largely on his own intelligence and initiative to gain that degree of efficiency which was necessary for him to carry on the very difficult, delicate and varied functions of the fitter and the smith. For the saw doctor must be both fitter and smith and a good many other things besides. He must be something of a scientist, should have some knowledge of steel making, and he must understand a good deal about the behaviour and idiosyncrasies of the machines on which his tools are destined to work.

Now, the old method, largely rule-of-thumb though it was, produced some wonderfully efficient men for the purpose, who often worked with the crudest of tools, some of which were invented and made by



GRINDING THE "BACK-BEVEL" ON LONG PLANING KNIVES

themselves. But, although they were good enough for carrying on under old conditions, there were but few whose training had been sufficiently advanced to enable them to cope properly with the present-day requirements. During the past twenty years saw mill machinery has made enormous strides, and even more marked has been the progress in the manufacturing of saws and cutters which alone have rendered the present high outputs of these machines a possibility. With the rates of saw feeds doubled, and in some cases trebled, and with rotary planers doing over 300ft. per minute instead of 50ft., and with fixed knife planers feeding up to 450ft. per minute, the scientific maintenance of the tools which do this work becomes essential.

Science in saw doctoring came into being with the advent of the high-speed band mill, for without it these long unwieldy blades, of any width up to 18in., could never be run. Gradually those scientific methods have spread to other branches of saw mill tools, and better, and often automatic, appliances have been elaborated for assisting the saw doctor in his task. Thus it is that improvements in machinery and tools have outstripped the supply of men who are capable of maintaining them at full efficiency. To remedy this shortage or, perhaps one should say, to speed up the production of efficient, scientifically trained saw doctors, a "Saw Doctor's School of Instruction" was started in Sheffield, without any flourish of trumpets, a few months ago, and at it either the comparative tyro in the art may go right through the whole extensive curriculum, or the practising saw doctor, who is weak in one or other of the sections of his work, may come and concentrate on intensive education in certain of the subjects.

Again, the man who has been carrying on his work at a disadvantage, possibly in a badly lighted and imperfectly laid out shop with inferior tools, can at this school see the latest of plant, ideally situated for purposes of efficient work and being handled as it should be.

There is a further class of men to whom this school has already proved an attraction. It includes the saw mill manager and the saw mill owner, the former who is responsible for the output and quality of the factory, and the latter who has to pay the annual bill for saws and cutters and for their upkeep. We understand that some of this class have already taken off their coats and gone through a short course so that they might, at all events, know from a practical standpoint what modern saw doctoring really means and realise whether or not they have been losing money for want of using modern methods.

The Saw Doctors' School of Instruction, of which we give some views herewith and on page 418, though it is carried on as a totally independent concern and away from the works of the company concerned, owes its inception to the enterprise of Drabble and Sanderson, Ltd., the saw makers, of Elect Works, Sheffield. It is not a philanthropic institution, as moderate, tabulated fees are charged for the different courses, of which there is a considerable variety to suit the requirements of different pupils, some of whom may be there for a couple of months and others for perhaps only a couple of weeks. Messrs. Drabble and Sanderson conceived the idea of the school because, while men from all over the world have for years been going for tuition to their works, they consider that an industrial saw factory is not the ideal spot for intensive education, as men working on productive output cannot give their whole time to the learner, and that is necessary if he is to absorb his knowledge rapidly.

Thus it is that the Saw Doctors' School has its own premises at Morpeth-street, Sheffield, and its own instructors who can give their whole time to the education of the students. The school occupies the whole of a large first floor, of which three-quarters of the space is laid out as a very complete saw doctor's shop and the rest is cut up into various rooms comprising offices, library, reading and lecture room, and the commencement of a museum of timbers and various objects connected with the saw doctor's calling.

The shop is lighted all along its two sides, and there are no top lights, for they are the bugbear of the saw doctor. Arrangements are made for modifying the natural light as desired, and everything is provided for the proper adjustment of the electric lighting. There is a growing tendency in advanced saw doctors' shops to discard natural light altogether in favour of artificial light, because, if properly arranged and adjusted, it is far easier to discover and remedy minute defects in saw surfaces by its means than by any other.

The plant for dealing with large band saws naturally occupies a very considerable portion of the shop, comprising, as it does, long "levelling" and tensioning tables, each equipped with anvil, tensioning rolls, and supporting rolls for the blade as it is being operated on; automatic sharpening machines, which, with their standards, occupy an equal amount of space; lap grinder, brazing equipment, and swage setting and side dressing tools. Circular saws of any diameter can be dealt with, and there are, in addition to the appliances for levelling, tensioning, sharpening, &c., the try mandrel, which ought to be regarded as essential, but which one seldom sees in our saw mills, and appliances for swage and spring setting. Equally complete are the arrangements for dealing with frame and other reciprocating saws, and the too-little-understood capabilities of the inserted tooth saw are equally practically demonstrated.

Every facility is also given for the acquisition of a knowledge of cutter maintenance and the mysteries of balancing, "tracking" or "jointing," while the secrets of the micrometer grinding of planing knives and heat treatment of moulding irons are also made clear.

We believe that this is the first definite attempt in any part of the world to systematise the technical education of the men in what has become not only a profession in itself, but one which is more nearly akin to an art than anything else which an artisan is called upon to exercise.

The old-time saw doctor, it was said, was "born and not made." That was because, to be proficient in his calling, he had to be a natural genius and a very versatile one at that. And his tools were the hammer and the file. Even to this day the Americans call him a "saw filer," although the file now plays a very minor part in his equipment.

Few people, even in the ordinary saw mill, realise fully the extreme delicacy of the modern saw doctor's task. In everything that the saw doctor does minute accuracy is essential. He seldom has to work to measurements which allow a deviation of more than one-thousandth of an inch and often very much less. In tensioning a circular saw, for instance, which may be anything up to 8ft. in diameter, he must wilfully distort the surface of the plate by hammering it so that it may be thinner in certain places than in others. He must graduate that "tension" regularly from the centre to the rim and that graduation must be perfect all round its surface. He knows that every blow of the hammer that fails to fall on the right spot or is too heavy will be bad for the saw and can only be rectified by further damaging the saw. Further, he must vary the amount of tension to suit the peripheral speed at which that saw will run, and that speed will decrease gradually as the diameter lessens in sharpening. The tensioning of a big band saw is even more difficult, for not only must it be thinned with perfect regularity in the centre, but its back edge must be curved gently and uniformly from one end of its length to the other, and that length may be anything up to 60ft. or 70ft.

He must detect "lumps" in saws and cracks in saws and cutters, almost before they are there or, at all events, before they would be visible to the eye of the layman, and his ear must tell him not only when a saw is running badly, but what is the reason for its doing so.

These are only a few of the essentials of the modern saw doctor, and the rest of his work is equally difficult and requires the same minute exactitude. Thus it is that the old saying holds good to-day: he must primarily be born a suitable man. He must be not only intelligent and alert, but desperately keen on his work, for that work's sake, if he is to attain proficiency. But if he is to get there quickly he must also absorb a scientific knowledge and the art of handling modern tools, and the saw doctors' school should go far towards facilitating matters for him in that respect.

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The Rotor Ship Barbara.

As recorded in our Seven-day Journal note of October 8th, the German rotor ship Barbara recently returned to Hamburg after making a successful maiden voyage to Spain and Italy. She was built by the Actien-Gesellschaft Weser, of Bremen, for the German Admiralty, the purpose of her construction being to demonstrate and to allow further investigation to be made into the mercantile and navigational advantages of the Flettner rotor system. The Barbara ran her trials towards the end of July and was then handed over to the Hamburg shipowning firm of Robt. M. Sloman, jun. That firm has also in its fleet two other motor ships, the Sorrento and Amalfi, which are fitted with similar oil engine propelling machinery to that installed in the Barbara, and with the exception of a slight difference in beam the ships are identical in dimensions and equipment. The only difference is that on the Barbara there are three Flettner rotors, which are used to furnish auxiliary propelling power. It is expected that after the rotor ship has made several voyages some interesting comparative data will be obtained.

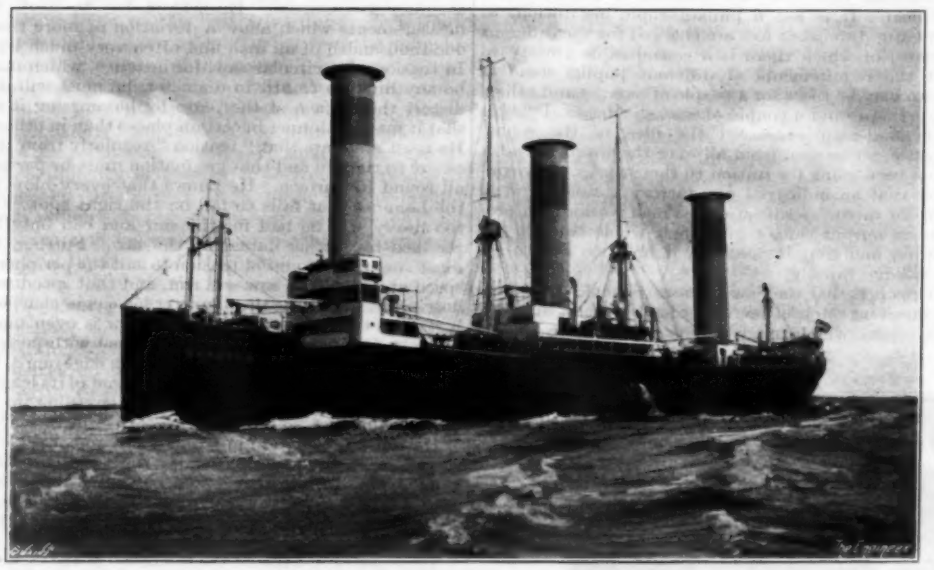


FIG. 1—THE ROTOR SHIP BARBARA

The view of the ship which we give in Fig. 1 and the drawing reproduced in Fig. 2 indicate the general appearance of the vessel. It will be seen that the three rotor towers, although actually the same as regards general dimensions, are arranged in descending heights from the bow of the ship. The foremost rotor, which stands higher above deck level than the other two, is mounted on the navigating bridge, which is built between the hatches of the holds Nos. 1 and 2. A bridge at the centre of the ship carries the middle rotor, whilst that further aft is built on a structure which is erected between the hatches of the holds Nos. 3 and 4.

Hull Particulars.—The principal hull particulars of the Barbara are as follows :—Length overall, 89·50 m.; length between perpendiculars, 85 m.; breadth moulded, 13·2 m.; depth to main deck, 5·97 m.; deadweight carrying capacity, 2830 tons ; gross tonnage, about 1700. Fig. 2 shows the general arrangement of the cargo derricks, which are served by electric winches. The ship is also provided with an electric indicator for the Flettner rudder, and it carries a gyro compass and full wireless equipment. Accommodation for officers and engineers is provided in cabin and saloon spaces amidships, whilst forward are the quarters for the crew. The rotors, which are electrically driven, are controlled from the navigating bridge, special slow-starting and braking appliances being fitted so that full advantage can be taken of the manœuvring effect obtained when the rotors are in operation.

Machinery Installation.—The main propelling engines consist of two non-reversible four-cycle single-acting Weser-M.A.N. marine oil engines. Each engine has six cylinders with a bore of 360 mm. and a piston stroke of 520 mm., and is designed for an output of about 530 shaft horse-power, giving a total power for the two engines—allowing for the 95 per cent. efficiency of the gearing—of 1010 shaft horse-power. As shown by the accompanying drawing, Fig. 4, the main engines are coupled to the single propeller shaft through Vulcan hydro-mechanical gearing, which reduces the normal engine speed of 300 revolutions per minute to a propeller speed of 80 revolutions. Each engine is furnished with its own fuel pump, air compressor, lubricating oil, cooling water, and bilge pumps, so that when running the main engines at sea no further auxiliaries are required. Special automatic starting valves are provided and the engines run up light, the propeller load being gradually applied by the Vulcan gear, which also serves to reverse the propeller. The manganese-bronze propeller is four-bladed and has a diameter of 4·2 m., with a pitch of the same dimension.

All the controls are worked from the starting platform. The exhaust pipes are carried up through the engine-room hatch through a low uptake of small diameter, and the heat from the exhaust is utilised for the warming of fresh water.

Fig. 4 shows the general plan of the machinery. In the port wing of the engine-room are arranged the various auxiliary pumps, and at the after bulkhead is the oil fuel heating boiler, which, according to the new German regulations, is accommodated in its own special compartment. The starboard wing of the engine-room accommodates the Diesel-electric generator sets which provide the current for working the motors driving the rotors, as well as supplying the electric winches, the auxiliary pumps, and general lighting system. There are two auxiliary generating units, one of 100 kilowatts capacity, which is driven by a four-cylinder Weser-M.A.N. airless injection oil engine. The engine is designed for an output of 150 brake horse-power and runs at a speed of 325 revolutions per minute. The diameter of the cylinder is 260 mm. and the stroke of the piston 360 mm. The second auxiliary unit has a designed output of 50 kilowatts and is driven by a two-cylinder 75 brake horse-power oil engine of the same type. In addition to these two auxiliary units a 15-kilowatt oil engine driven emergency dynamo with an air compressor is provided for use when the ship is in port. The main switchboard is arranged near to the after bulkhead in the starboard wing, while at the forward bulkhead are grouped the controls and air receivers for both the main and the auxiliary oil engines. Oil bunkers and

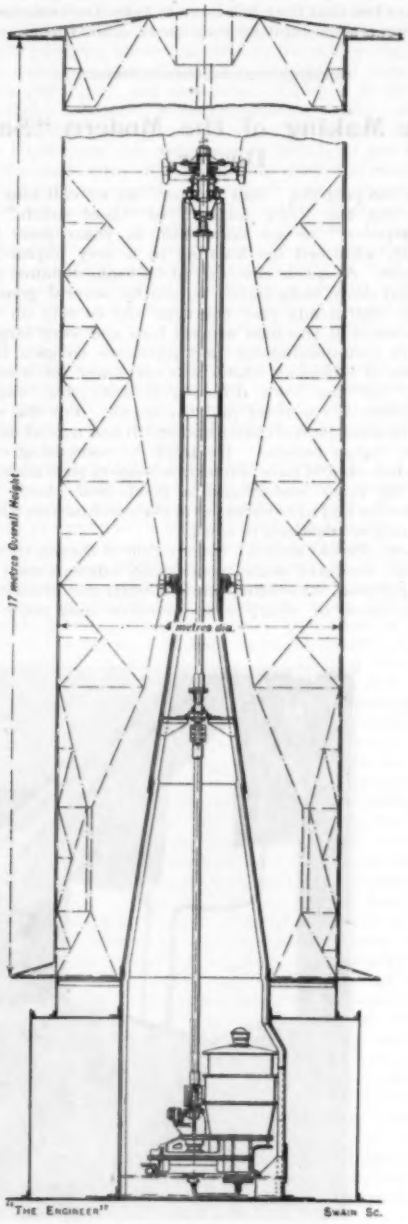


FIG. 3—SECTION OF A ROTOR

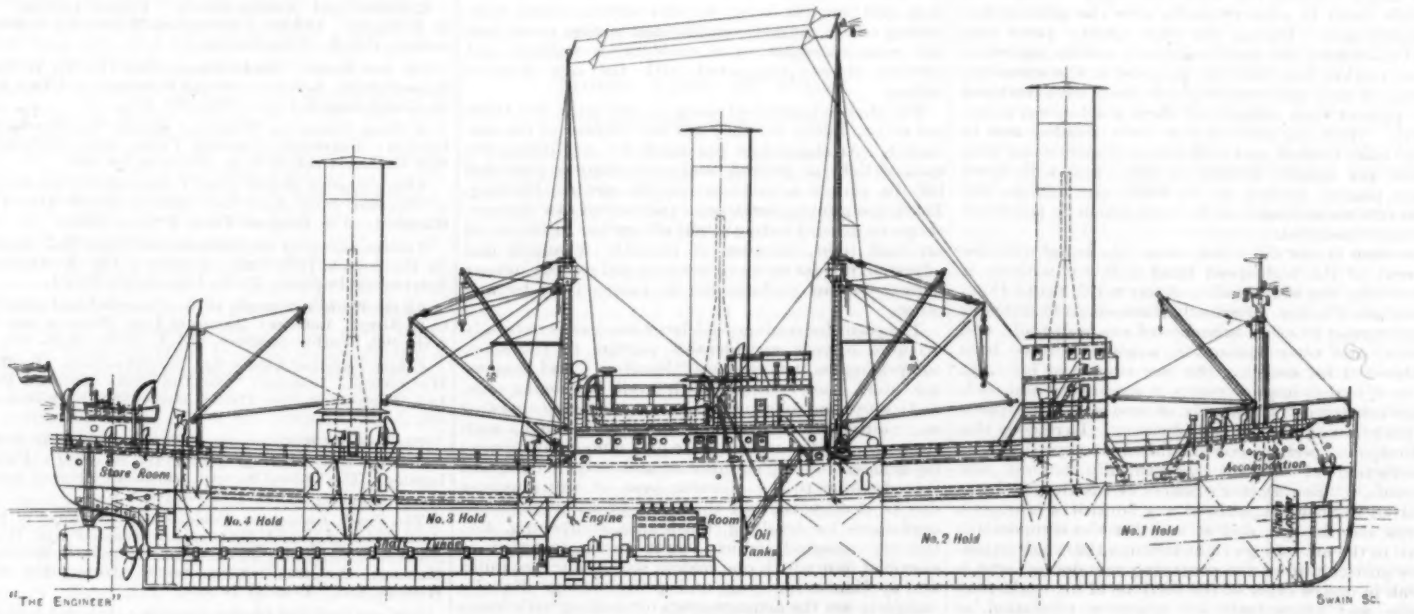


FIG. 2—ROTOR SHIP BARBARA—LONGITUDINAL SECTION

daily ready use tanks are arranged between the engine-room and the No. 2 hold space. The double bottom of the ship is also adapted to carry both oil and water ballast.

The Rotor Equipment.—The chief interest of this ship attaches to the Flettner rotors, their design and the method of driving them. One of the rotors with its geared motor drive is illustrated in Fig. 3. In a recent number of our German contemporary, *Schiffbau*, Mr. Robt. Otto, of the Flettner Company, gave some details of the rotors equipment and the performance of the vessel since her completion. These particulars are summarised in the present article. In the original design it was intended to employ only one rotor of large dimensions, but a consideration of the bearing problems resulted in a decision in favour of three rotors, each 4 m. in diameter and 17 m. in height, each having a surface area of 68 square metres or a total area for the three rotors of 204 square metres. The rotors are larger than those fitted in the rotor ship Baden Baden, ex Buckau, which were designed to utilise effectively wind speeds up to 6 m. per second. In the case of the Barbara wind speeds up to 10 m. per second can be made use of and the rotors may be driven at speeds up to 160 revolutions per minute. The general arrangement of the rotor drive is illustrated by Fig. 3. It will be seen that the rotor is driven by a vertical type motor with spur gearing having a reduction ratio of 6·54 to 1, the motor being designed for an output of about 41 brake horse-power at a maximum speed of 1050 revolutions per minute. Double thrust bearings are fitted so that the driven gear wheel is kept in position and the whole of the gearing works under oil pressure. The driving shaft is carried up to the pivot bearing in two short lengths with an intermediate bearing. The pivot bearing through which the drive is transmitted to the rotor by a three-claw link type flexible coupling is placed at about two-thirds the height of the rotor, with a further supporting bearing at about one-third the height of the rotor. The bearings are of the ball and roller type and provision is made for carrying the weight of the rotor and the vertical shaft.

Considerable care was taken so to design the cylindrical part of the tower that it would withstand the stresses which might arise by reason of the rolling and pitching of the ship. The shells themselves are built up of a light metal, "Lautal," which has a specific gravity of 2·8 and the following physical characteristics:—Ultimate breaking strength, 38 kilos. to 42 kilos. per square millimetre—about 25 tons per square inch; elastic limit, 28 kilos. to 32 kilos. per square millimetre; with an elongation of 18 to 25 per cent., the modulus of elasticity being 650,000 to 700,000. "Lautal" metal can be riveted and heat treated and the shell plates have a thickness of 0·8 mm., or about $^{1}/_{32}$in. They are each supported by nine vertical bridge girders, to which are attached some twenty-three ring members. The girder work was built up of "Lautal" metal drawn in channels and angle sections, such as are used for aeroplane and airship construction. The strip material was delivered at the Weser yard and after bending to shape it was hardened in oil at a temperature of about 120 deg. Cent. The upper and lower ends of the rotors are constructed of the same material as the shell, and it will be seen from Fig. 3 that the rotors are closed at the top and bottom, so that no air can enter them. Access is given to the driving motors, and the bearings may be inspected by means of an internal ladder when the rotor is stationary.

Summary of Trial Results.—The preliminary trial of the Barbara was run on July 16th, and on the 24th, 26th, and 28th of that month further tests were made before the ship was handed over to her managing owners. On the first-named date, with the ship in ballast and a wind velocity corresponding to about 4 on the Beaufort scale, the following results were obtained:—

(*a*) With the rotors only in operation at a speed of 140 revolutions per minute and a broadside wind a ship's speed of about 5·5 knots was attained. During this trial the propeller was uncoupled and was rotated by the water flowing past it at a speed of about 25 revolutions per minute.

(*b*) With the same wind conditions with one engine working at full power and the rotors stationary the ship made about 7 knots.

(*c*) Under the same conditions with only one engine running and with the rotors turning at 130 revolutions a speed of 9·5 knots was recorded.

(*d*) With a broadside wind, both engines operating at full power and the rotors stationary, the speed of the ship was 9 knots.

(*e*) Under similar conditions with both engines running at full power and the rotors turning at 130 revolutions per minute a speed of 10·5 knots was attained.

On July 26th further trials were run with the ship again in ballast, but during these tests the velocity of the wind corresponded to a value of 6 to 7 on the Beaufort scale. The following results were obtained:—

(*a*) With both engines running at full power and the rotors stationary, wind between ahead and broadside, a ship's speed of 6 knots was attained.

(*b*) When one engine only was in operation at full power and all the rotors turning at a speed of 140 revolutions the ship made 6·25 knots.

(*c*) With the wind blowing from about halfway between aft and broadside, one engine operating at full power and all the rotors turning at 140 revolutions, a speed of 10·5 knots was recorded.

(*d*) When the rotors only were in operation and were turning at a speed of 150 revolutions, with a wind nearly broadside on, but a few degrees aft, a ship's speed of 9 knots was registered. The uncoupled propeller was turned at about 40 revolutions per minute by the water streaming past it.

(*e*) Under similar wind conditions, but with both engines running at full power, and the rotors stationary, a speed of 9 knots was again made.

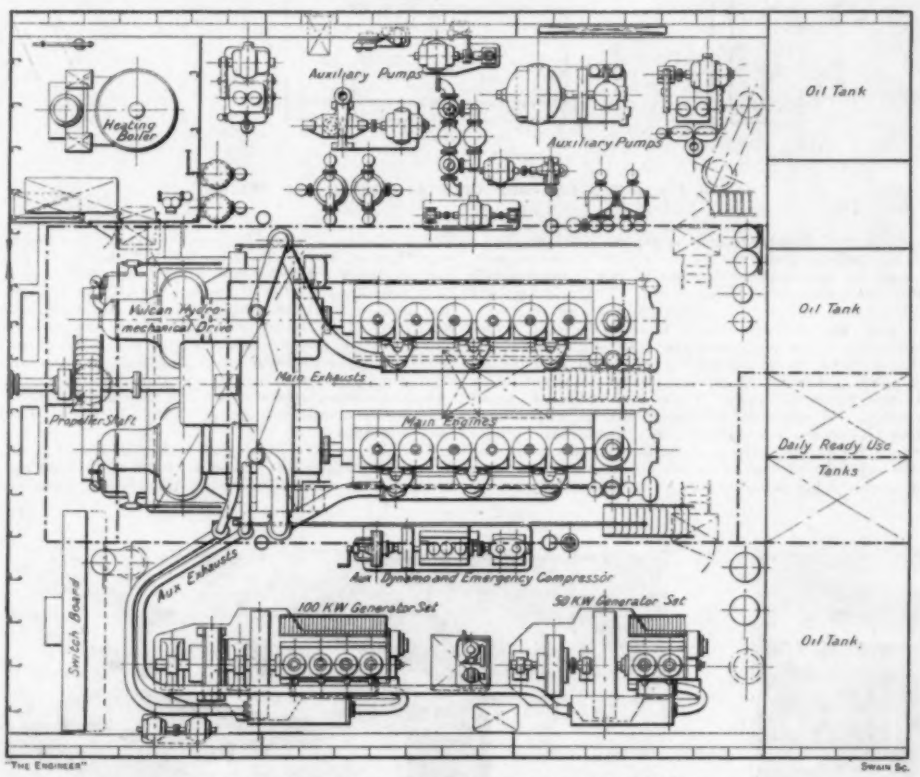


FIG. 4—ROTOR SHIP BARBARA—PLAN OF ENGINE ROOM

The results above quoted do not, of course, enable an estimate to be made of the value of the Flettner rotor principle. They show, however, what speeds have been recorded under varying trial conditions, but further results from actual voyages must be awaited. During the recent trip of the Barbara to the Mediterranean, on the outward journey there was little opportunity to use the rotors owing to lack of wind strength. On the return journey, however, the rotors were employed, and it is reported that with the engines running at half speed full speed was made by the help of the rotors, which reduced the fuel consumption of the oil engines by about one-half. The maiden voyage of the Barbara apparently demonstrated that, mechanically, the installation was free from trouble, and further comparative data regarding the navigational and economic advantages of the system will doubtless be published by the owners at a later date.

The Rand Gold Industry.

JOHANNESBURG has just celebrated the fortieth birthday of the great Witwatersrand gold field, from the reefs of which gold to the value of £840,000,000 has been extracted. On September 8th, 1886, President Kruger, of the South African Republic, issued a proclamation declaring the farms Driefontein and Elandsfontein to be public diggings from September 20th, 1886. Other farms were to become public diggings on September 27th and October 11th, 1886.

Gold is stated to have been found by an Englishman named Davis at Paarde Kraal, on the Witwatersrand, in 1852. At that time Audries Willem Pretorius had established a form of Government at Potchefstroom, where he held the position of Commandant-General. He heard of the discovery, and ordered Davis to come before him and to bring the gold. Davis did so, and said it was pure gold and worth £600. Pretorius bought the gold but prohibited Davis from digging further for gold, stating that he was certain that foreigners would take the country from his people if they became aware that gold had been discovered in it. There is no doubt that the Boers, or, at all events, some of them, were aware of the presence of gold on the Rand field before it was discovered by Walker, Bantjes, Struben, and others of the pioneers, but they were imbued with the same spirit in the "eighties" as Pretorius was in the "fifties." They detested the idea of "foreigners" being attracted to the Transvaal, and wished to keep the whole country for themselves and their descendants. Though the Republic was penniless—it was only saved from bankruptcy by the opening up of the mines—and they themselves were poor, those Boers who knew of the presence of gold did nothing, and said nothing, and so the reservoir of wealth which was destined entirely to change the history of South Africa remained sealed up until 1886.

There are various stories as to how, where, when and by whom the original discoveries of gold on the Witwatersrand were made. It would appear that a Mr. Van der Hoven, who lived at Potchefstroom, made a trip in 1881 to the Witwatersrand, and that, while outspanned near Rietfontein, he came across some conglomerates which he considered to have a singular formation and possible to be diamond bearing. However, he did not pursue the subject, and, after a careful sifting of reliable evidence, there seems to be little doubt that the first work carried on Banket formation was done by Mr. Fred Struben, on the farm Honingklip in March, 1885, he having discovered two banket reefs there. The original discovery of the Main Reef Series was made a little later by a former employee of Struben's, named Walker, and a friend, on Langlaagte, in 1886. Shortly afterwards Struben sank a 40ft. shaft on Vogelstrusfontein, and that was the first Main Reef shaft. A Mr. Hendrick Bantjes was advised by Mr. Struben to try one of the banket beds on the extreme northern edge of the Farm Roodepoort. He did so, and extracted about 20 tons of ore, which was crushed at a small mill belonging to the Struben Brothers, in 1886. These were the first conglomerates milled on the Rand. The results were practically nil, and the disappointment was great. Mr. Struben, however, did not lose faith, and in March, 1886, he struck the Bird Reef on Vogelstruisfontein, and milled about 50 tons, yielding about 6 dwt. to the ton.

After that events moved fast, and the Main Reef series was located, companies were formed, and mining operations proceeded on a rapidly increasing scale. In those days Johannesburg thought in ounces of gold to the ton, for the mining was then in the rich oxidised ore. The first four tons taken from the Wemmer Mine gave no less than 36 oz. Meantime the outcrop had been found further east in a cross-cut, and from there 2 tons from the capping were crushed, yielding 22 oz. of gold. A few tons were then crushed from the Ferreira Mine, and gave 50 dwt. per ton.

The total production for the year 1887 was 23,125 oz. from twenty-three mines. The production for 1888 was 206,121 oz., and for 1889, 369,557 oz., or as much as is now produced by one mine only, Government Areas, in four months. Last year the gold produced by the Transvaal Mines was 9,599,702 oz.—from 28,682,238 tons of ore—and for this year it may quite possibly reach 10,000,000 oz. for the first time.

The importance of the gold mines to South Africa is clear from the following facts and figures. In 1925 the Transvaal gold mines crushed 28,682,238 tons of ore, yielding 9,599,702 oz. of gold—6·570 dwt. per ton of ore crushed—of a value of £40,234,265; the working costs amounted to £27,668,373, the estimated working profit was £12,565,892, and the dividends paid amounted to £8,272,853. There was expended in wages for Europeans and non-Europeans nearly £14,000,000; while stores purchased cost nearly £15,000,000—including coal mining, &c., the total was £15,997,453. Of this latter amount over £6,000,000 was expended in South Africa, though, in all probability, the local firms which obtained the orders had to import much of the machinery, material, &c., from overseas. Finally, the total value of exports from South Africa for the year 1925 was £86,840,612. Of this sum gold amounted to £41,401,376. Including diamonds, coal, copper, tin, &c., the total value of the Union's mineral export for 1925 was £52,316,296. For 1926 the total should show an increase of about £2,000,000, as, so far, the demand for diamonds has been greater, and the production of gold has increased.

There is, however, a cloud in the background, which grows larger, blacker, and nearer every year, for the days of the Rand are numbered. According to the Government mining engineer, Sir Robt. Kotze, nineteen mines, with a crushing capacity of 6,620,000 tons, have a life of less than five years; a further eleven mines, with a capacity of 7,078,000 tons per annum, have a life of from five to ten years, while seven mines, with a capacity of 9,772,000 tons per annum, have a life of ten to fifteen years, and only two mines are put down as having a life of twenty to thirty years. Even after fifteen years, Sir Robt. Kotze estimates that the crushing capacity of the mines will only be 5,122,000 tons. The estimate, of course, refers to the existing forty-seven mines. As a matter of fact, there is land still available for leasing, equal in extent to 29,518 mine claims, contained on some twelve farms. A number of these, however, only contain the main reef series at depths varying from nearly 3000ft. to close on 5000ft., and as mining at a greater vertical depth than 7500ft. is very doubtful, the additional ore they can supply must be greatly discounted. The most promising areas do not, between them, contain more than 2000 mining claims, or less than the area of any one of a number of the mines now producing.

It is estimated that if the mining costs could be reduced from the present average of 19s. per ton to about 15s., that over 150,000,000 tons of low-grade ore now unpayable would be brought into the payable zone. Even this addition would only add six years or so to the life of the gold-fields of the Union. In referring to the claim areas still available, the area of over 2000 claims lately acquired by the Sub-Nigel have not been included, nor has the Geduld area of about the same number of claims, for which the

Union Mining Corporation has recently tendered. As far as the Sub-Nigel is concerned, if the new area is as payable as believed it will extend the life of that mine by some twenty years or so, which will mean that at double the present output the mine will outlast all others now existing. It is evident, however, that there is no general extension of the life of the Rand, or of the gold mining industry generally to be obtained from any of the above sources. It is quite possible that gold will be discovered in other parts of the Union and worked, but it is difficult to imagine that any field capable of replacing the Rand can have been overlooked. The greatest hope appears to lie in the direction of base minerals and metals mining. Gold and diamonds have hitherto completely overshadowed all the other minerals, and prospectors have given but little attention to the Union's deposits of copper, tin, &c., although several small copper and tin mines are being worked, and the presence of those metals is known in a number of districts.

At present the high price of tin has given an impetus to the search for fresh sources of supply, and prospectors are at work in the Union. American engineers are investigating on behalf of American capital. One American company has secured a two years' option over a copper-bearing district in the South-West Africa country—of which the Union is the mandatory power. It is very probable that important discoveries will be made during the next few years, though it is to be feared that at the best they will fail to replace the gold-mining industry, which has now reached its zenith, and from now on will gradually dwindle. It remains to be seen if Johannesburg will be saved from the fate which, in other gold-mining countries, has overtaken the towns which have sprung up on important fields, and the existence of which has been as ephemeral as that of the fields that brought them into existence.

GERMAN RAILWAY WAGON COMBINE.

His Majesty's Consul at Leipzig has informed the Department of Overseas Trade that, according to local press reports of recent dates, negotiations are proceeding in the direction of a combine between the following:—Linke-Hofmann-Lauchhammer A.G., Berlin; Waggonfabrik van der Zypen and Charlier, Cologne; Talbot, Aachen; Waggon und Maschinenfabrik A.G. vormals Busch, Bautzen; Gothaer Waggonfabrik A.G., Gotha; Waggonfabrik A.G., Urdingen; Eisenbahn-Verkehrsmittel A.G., Berlin.

The combine is apparently to take the form of a fusion of these companies. A new company is to be formed. The capital of the various companies is to be brought into the new concern in exchange for shares of the latter. The capital of the new company is not yet fixed. Through the combine it is hoped to cheapen production, to get greater concentration and improved organisation. Waggonfabrik van der Zypen in Cologne and Talbot, Aachen, belong to the Wagenring, G.m.b.H., but other firms belonging to the same organisation, *e.g.*, Maschinenfabrik Augsburg-Nürnberg A.G., the Esslinger Maschinenfabrik and the Maschinenfabrik Gastel in Mainz will not, it appears, join the combine. It will be difficult to incorporate the Linke-Hoffmann-Lauchhammer, A.G., with all its varied interests, in the new organisation unless it is intended to bring in only the two wagon works belonging to the company in Cologne and Breslau, together with the Eisenbahn-Verkehrsmittel A.G., which belongs to the sphere of interests of Linke-Hofmann-Lauchhammer A.G.

Concrete weighing 153 lb. per cubic foot is being obtained in the construction of the new city hall for Pasadena, California, through the use of three sizes of aggregates the mixture running one part of cement to about two parts of sand, 1·1 parts of pea-gravel and 2·9 parts of coarse gravel. The grading factor of the combined aggregates averages about 5·4. The pea-gravel ranges in size from ¼in. to ½in., and the coarse gravel from ½in. to 1½in. The concrete going into the structure shows, it is said, a strength of well above 3000 lb. per square inch at the age of twenty-eight days.

The Soho-square Sub-station.

After important extensions and rearrangement, the Soho-square sub-station of the Charing Cross Electricity Supply Company was officially reopened on Tuesday last. Apart from the fact that it is probably the first underground automatic sub-station in this country, it possesses novel features. Originally the sub-station at this point consisted of a large street box containing six mercury arc rectifiers with a total capacity of 200 kilowatts, but in consequence of the fact that the equipment proved inadequate to meet the demand, underground plant was put into operation in 1925. Two 300-kilowatt rotary converters designed for automatic operation were installed in an excavated chamber under the pavement and roadway opposite Carlisle-street, on the west side of the square, and recently considerable extensions and improvements to this sub-station have been made. The underground chamber has been extended and the sub-station now contains four 300-kilowatt rotary converters with transformers, switchgear, and automatic control gear, designed for the purpose of converting the incoming 10,000-volt, three-phase, 50-cycle supply into direct current at a pressure of 202 to 212 volts. The plant has been designed to run entirely automatically and without attendance, beyond the occasional visits which all automatic plants require. When the voltage falls on the direct-current mains the plant starts up on its own accord and shuts down again when the load diminishes. To maintain the pressure on the direct-current network within half a volt of the proper value voltage, regulating equipment is provided. Moreover, the automatic control gear has been designed to give sequence control, and consequently the machines may be made to start up and shut down in any desired order. The contractors believe that this sub-station, which will ultimately contain five machines, of the capacity mentioned, is the only sub-station in the world that is equipped for sequence control of so many units.

The general lay-out of the sub-station, which was equipped entirely by the Metropolitan-Vickers Electrical Company, is shown in Fig. 1. The high-tension three-phase supply is provided by two high-tension feeders at a pressure of 10,000 volts. The high-tension switchgear consists of two Metrovick oil switches of the "K" type, enclosed in sheet steel cubicles, each unit having a breaking capacity of 150,000 kilovolt-ampères. Four oil switches control the supply to the machines and provision has been made for an additional unit when the fifth machine is installed. To enable two machines to be operated from each feeder bus-bar, sectionalising switches are provided. By means of ³/₀-phase oil-immersed transformers, to be seen in the background of Fig. 2, the pressure of the incoming alternating current is reduced to a pressure of 152 volts, and at that voltage the current is supplied to the slip rings of the rotary converters. In order that the transformers might pass through the small entry to the sub-station, the cooling radiators were made as separate units and were bolted to the transformers after erection.

The machines—see Fig. 3—are standard Metrovick tap-started rotaries running at a speed of 1000 revolutions per minute and delivering direct current at a pressure of 202–212 volts through feeder circuit breakers to the network. The low-tension switchboard has four machine panels, but space has been provided for a fifth panel. Each panel is fitted with 1500-ampère main contactors and similar shunt contactors with overload resistances. There is also a separate panel carrying the sequence control gear, the low-tension bus-bars being duplicated and provided with change-over switches for connecting each machine to either set of bus-bars. The low-tension line pressure is adjusted by means of an automatic voltage regulating equipment which maintains the pressure within half a volt of the proper value. If necessary, however, the complete sub-station equipment, including the voltage regulating apparatus, can be operated manually, and the sub-station can also be shut down or may be prevented from starting by means of a control switch at the St. Martin's lane sub-station.

The automatic control gear shown in Fig. 4 is of the Metrovick standard type and is designed to start up the first machine when the bus-bar voltage falls below a certain value and the second and subsequent machines when the load on the bus-bars exceeds a predetermined value. When the load on the bus-bars falls to a value which can be carried by a smaller number of machines than are actually running, the last machine in the sequence is automatically disconnected and shut down and in each case time-delay devices prevent operation of the apparatus if the change in the conditions is not maintained for a predetermined period. A novel feature of the sub-station is that the sequence in which the machines are started and shut down can be pre-arranged. For that purpose the starting panel of each machine is fitted with a plug receptacle, into which a plug-carrying sequence control leads, for that machine can be fitted in five different positions, and, according to the position selected, that machine will start up first, second, third, fourth, or fifth in order. The plugs have differently arranged contacts, and in whatever the order in which the machine is started a complete sequence is always secured. The order of shutting down is similarly controlled by the sequence apparatus and is the reverse of the order of starting up. In the event of any machine

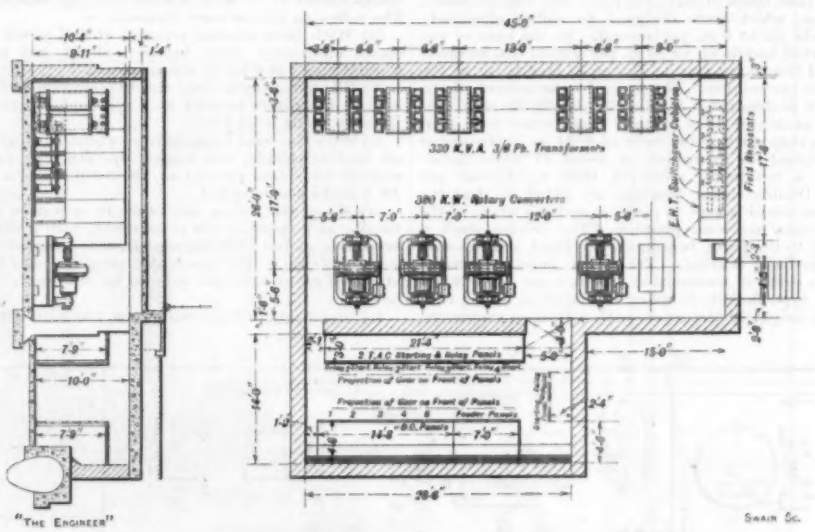


FIG. 1—GENERAL LAY-OUT OF SOHO-SQUARE SUB-STATION

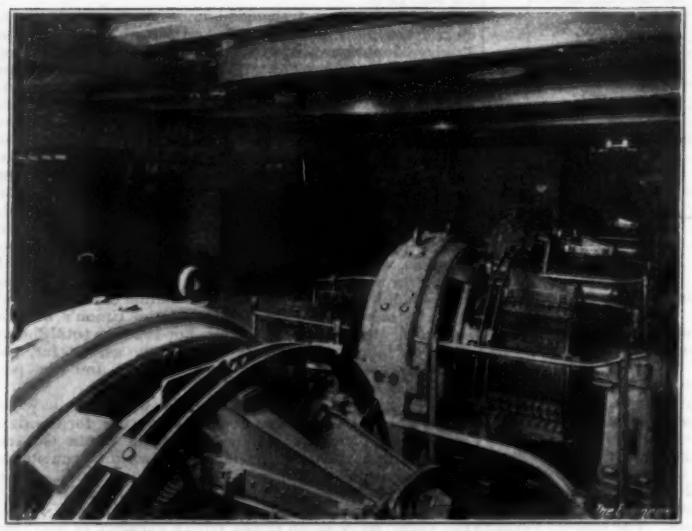


FIG. 2—TRANSFORMERS AND ROTARIES

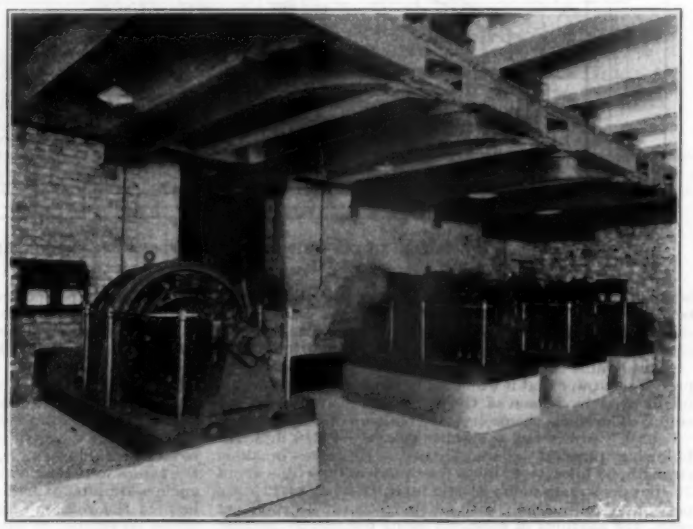


FIG. 3—SLIP-RING ENDS OF ROTARIES.

being locked out as the result of a fault, when its turn comes to start, the automatic gear starts up the next machine in the sequence. If for any reason other than a lock-out a machine fails to connect itself to the system in its turn, the next machine in the sequence is automatically started after a time delay.

The motor-driven drum controller, by means of which the sequence control system is operated, is shown in Fig. 5. The various relays cause the motor to drive the drum by stages in a forward or reverse direction as required to stop or start the machines, and a point of special importance in connection with this particular sub-station is that

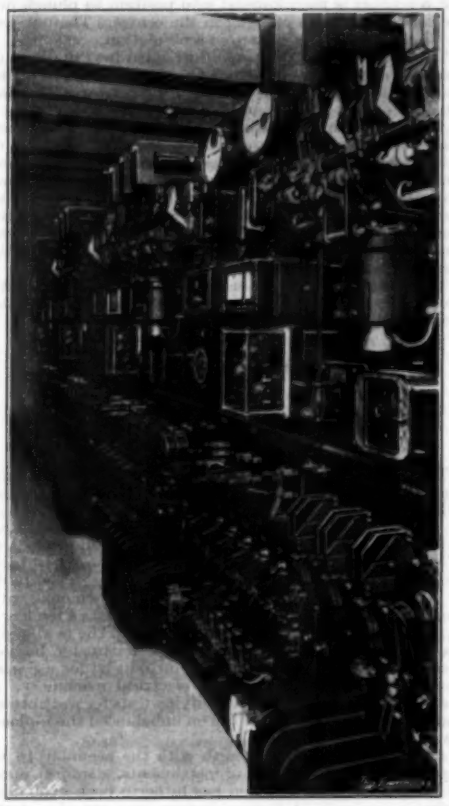


FIG. 4—AUTOMATIC CONTROL GEAR

the sequence can be altered at any time and even whilst the rotary converters are running. Any machine can consequently be put out of commission and shut down for examination without in any way interfering with the operation of the sub-station as a whole.

Protective gear designed to meet all contingencies has been provided, and during a recent visit to the sub-station we had an opportunity of seeing how well some of this gear performed. Whilst the safety of the equipment is assured, the possibility of interruption to the service is reduced to a minimum. If the load exceeds the safe load of the machines, current limiting resistors are automatically inserted in circuit with all the rotaries, so that the load is limited to a safe value and is shared equally by all the

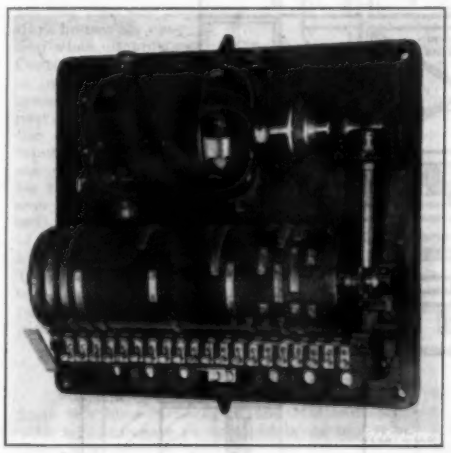


FIG. 5—SEQUENCE CONTROLLER

machines that are in operation. In the event of the overload being prolonged, thermostats cut out the machines until the resistances have cooled, when the rotaries automatically re-start. Moreover, in the event of any trouble that cannot be automatically cleared, such as the failure of a machine to start or the overheating of bearings, a lock-out relay operates and puts the affected machine or machines out of commission until the station has been visited and the trouble has been remedied, whilst in the meantime the sequence control gear maintains the operation of the other machines without interruption. A fan mounted in the air duct serves to ventilate the sub-station, and if the station is under sequence control the fan is started automatically when the first machine is put into operation, and it continues to run until the sub-station is shut down.

The installation forms an interesting example of the manner in which the difficult problem of providing space for a sub-station in a part of London where the cost of building space above ground is practically prohibitive may be solved, and it is considered that the employment of similar sub-stations may prove an effective method of dealing with overloaded networks in other congested areas.

COLLIERY RAILS AND STEEL ARCHES FOR USE IN MINES.

The British Engineering Standards Association has just issued British standard specifications for light rails and fish-plates for use in mines (flat bottom and bridge) and for steel arches for use in mines (straight sided and horshoe arches).

These specifications have been prepared at the request of the Mining Association of Great Britain by committees representative of both the buying and the manufacturing interests, which have been assisted in their work by regional committees that have been formed in the major coalfields to ensure that local conditions receive the fullest consideration.

The British standard sections of light rails and fish-plates for use in mines reduces the number of rail sizes and sections employed in mines from the present thirty-eight sizes with twelve or more sections of each size to five bridge rail sections and nine flat-bottom rail sections, with one section of each size.

It is estimated that a very large saving will eventually be obtained by this reduction in the number of different rail sections, since it must entail a large reduction in the number of rolls required by the rail rollers, reduction in stocks, acceleration in delivery and other well-known advantages of standardised production.

It is not expected that the present condition of affairs can be changed immediately, as the capital cost of such a proceeding might outweigh any benefit that would be gained by the quick change. The process will of a necessity be a gradual one, the older sections being gradually eliminated as they are worn out and replaced by the standard sections. That this elimination should take place, however, can hardly be questioned.

The total annual purchase of light rails for use in mines is about 80,000 tons, which at a purchasing figure of £9 per ton represents over £700,000 per annum as the cost of the rails to the collieries. If a reduction of only 5 per cent. is made in the cost of production—a figure that is certainly below the saving that could be effected—it would represent a saving of approximately £36,000 per annum.

Although the change-over to the use of the standard sizes will probably entail some slight inconvenience at the outset, no serious difficulty will be found in making use of them for replacement or other purposes in conjunction with existing sections, as the differences in sizes of important dimensions is within the allowable wear, and it is important that individual collieries should realise the necessity of adopting the new sections if the economies are to be obtained.

The specification for steel arches, which are coming into general use at collieries in this country, contains certain clauses governing the quality of material and dimensions of both straight-sided and horshoe arches, and will tend to prevent the multiplicity of types of sizes of these roof supports so usual in this type of appliance when it is left to haphazard development.

Copies of these two new specifications, Nos. 227 and 248, may be obtained from the B.E.S.A. Publications Department, 28, Victoria-street, London, S.W. 1, price 1s. 2d. each post free.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

THE ROTOR SHIP AND FLETTNER RUDDER.

Sir,—The continued Government assistance to Dr. Flettner's experimental vessels in Germany is not only a striking example of the State attitude to invention, but would lead one to suppose that the earlier efforts with the Buckau led to more practical results than were generally accepted, in this country at any rate, nor, I confess, despite the experiments described some twelve months ago as performed in your offices, is it easy to appreciate the practical application of the Magnus effect to the exclusion of sail power of equal area and under equal circumstances of wind and weather. However, doubtless we live and learn much in these days, and comment may be wisely reserved till the final data of the recent trials are available.

There is, however, another and earlier invention by the same author which, considered in terms of resolved forces, I think at once shows its claimed advantages to be based on a fallacy. I allude to the Flettner rudder.

This rudder, as most folk connected with maritime matters are aware, consists of a large rudder, freely suspended for movement, in the trailing edge of which is mounted a small pilot rudder controlled by a hand steering wheel, the action being such that when the small rudder is put over to starboard—starboard and port being here expressed in terms of tiller steering, though no tiller be actually employed—the flow of water passing it urges it bodily to the right, taking the trailing edge of the main rudder with it, and consequently placing the main helm to port, the ship's course being directed by the action of the larger plane surface, so that in this case her bows will swing to starboard under port helm.

But it is quite clear that the forces acting upon the two rudders of different area must very soon cancel out, and that when the small rudder has imparted quite a small degree of steerage helm to the main rudder, a state of equilibrium must be reached which will preclude any really powerful helm effect being imparted to a vessel by this method of steering.

If the application of the invention be considered—it is, I understand, intended for the large Rhine barges—it is quite clear that a large barge may be given a small degree of helm with a minimum expenditure of energy on the part of the helmsman, and fine handling and possibly a straighter wake may be maintained; but none the less the steering power must come from somewhere, and, of course, in this case comes from the increased resistance to motion imposed by the pilot rudder acting against the main rudder, so that the work which formerly was supplied by the steersman is now supplied by the tug or towing agent. It would be interesting to obtain the mean tow rope pull for a string of ordinary and a string of Flettner rudder barges under like conditions over a long tow.

STANLEY P. CHRISTIE.

London, S.W. 10, October 11th.

RETAINING WALLS AND GEOSTATIC THEORIES.

Sir,—The writer ventures to comment upon an article by Mr. F. W. Woods, which was published in your issue of June 11th, 1926, and to observe that although he has often seen earth cliffs in the West Indies similar to those described by Mr. Woods, with their upper levels almost vertical and semi-parabolic, he has, at the same time, found the plane rupture to be more wedge-shaped than the parabolic segment exhibited by the author—Fig. 1—which is really a form of the cliff subsequent to rupture, when it is approaching its angle of repose. One actually sees cliffs which are quite concave, but this is due to higher internal resistance in the upper levels, more often than not brought about by the presence of innumerable plant roots, traversing in all directions through the soil or by varying soil conditions.

So many and complex are the cases which occur in practice, and so restricted is our knowledge of the science of soil action, that the economy or otherwise in the design of a wall in any special case depends upon the judgment of the engineer in choosing the intermediate value between the extreme ones.

Undoubtedly, the plane of rupture depends upon the cohesion of the material and the actual extent of earth pressure to be resisted by a retaining wall is the pressure usually allowed for, found by applying the Coulomb-Rankine granular theory, less the coefficient of cohesion. The case taken by Mr. Woods is one of a cliff with a high coefficient of cohesion. He states with

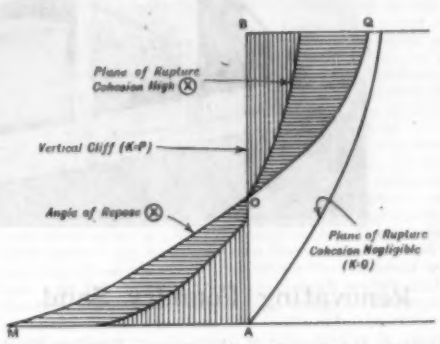


Fig. 1

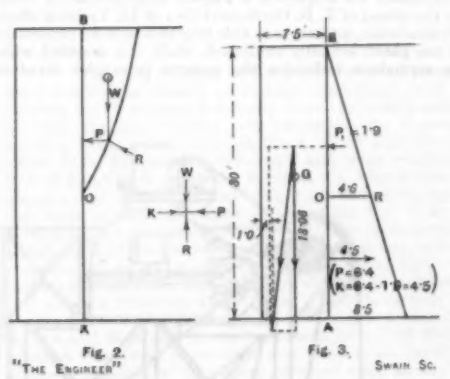


Fig. 2. Fig. 3.

"THE ENGINEER" SWAIN SC.

indisputable truth that if a thin wall had been built against the vertical face A B of the cliff the earth pressure would not exceed that due to the triangular prism A O M (= the parabolic segment B O Q). The writer observes that the same would apply if a strutted wall had been built against the portion O B of the cliff, and that in both cases the resultant earth pressure would cross the line O B and not O A of the cliff at one-third A B from the bottom. The lower portion O A would be stable under its own internal forces. He would suggest that the resultant earth pressure be found passing through the point of intersection of the vertical line drawn from the centre of gravity of the parabolic segment and the plane of rupture—Fig. 2. Closer results therefore would be obtained by finding the value for P in the usual manner and by establishing the position of O in A B, when P_1 would equal the area of the △ B O R times W_1, and would act at one-third O B above O. It will be seen that although P is reduced thereby, the moment arm is increased, and the resultant pressure tends to approach the toe.

Applying this to the case of the wall 30ft. high and 7·5ft. thick, P_1 = 1·9, and the resultant strikes the base 1ft. from the toe—Fig. 3. The maximum intensity of pressure at the toe is 8·7 tons. The △ B O R represents P − K, where K is the force of cohesion. K may vary from K = O to K = P, the former being the case for sand or any other material which has negligible cohesion, and the latter for a material which will remain in the form of a vertical cliff without external assistance.

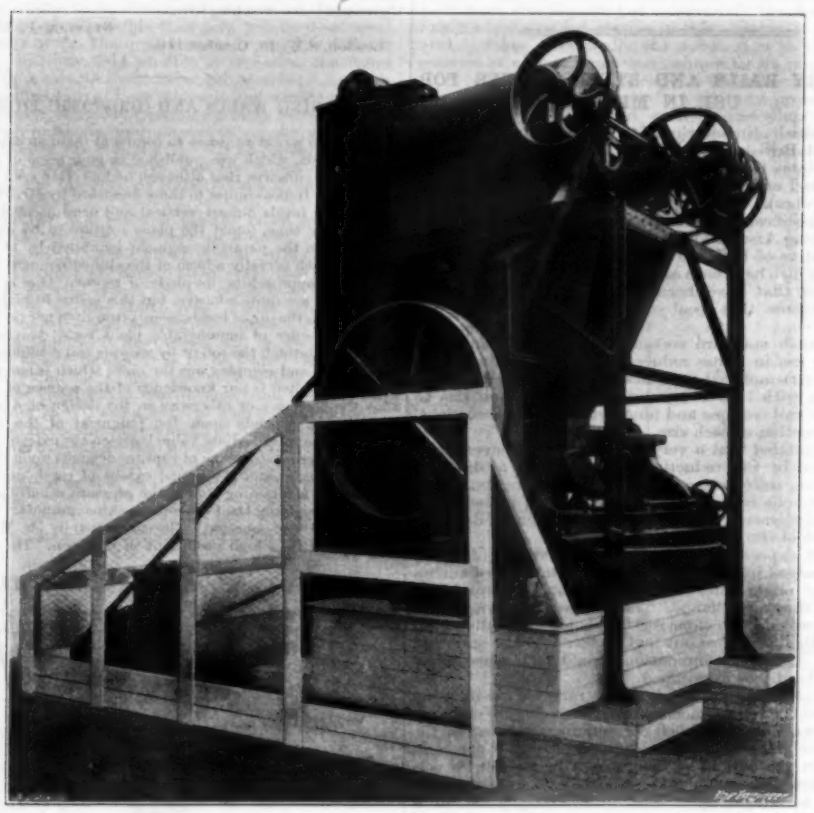
A. W. ROGERS.

Sanchez, Dominican Republic, West Indies,
September 21st.

ATMOSPHERIC conditions interfered with the ventilation of the Ricken Tunnel, near St. Gallen, Switzerland, one day last week, and a double-headed goods train was stalled in consequence of the enginemen becoming incapacitated. Relief was sent, but the rescuers, too, were overcome, and eight men in all, including five with the first train, were asphyxiated.

MACHINE FOR RENOVATING FOUNDRY SAND

J. B. CORRIE AND CO., WESTMINSTER, ENGINEERS



Renovating Foundry Sand.

During the course of the recent Foundry Trades Exhibition we inspected a French sand-preparing plant, on the stand of J. B. Corrie and Co., of 15, Victoria-street, Westminster, and are now able to give above an illustration of the plant actually exhibited, while the drawing which we reproduce indicates the general principles involved, although in the latter case parts of the apparatus are duplicated in order to increase the rate of output.

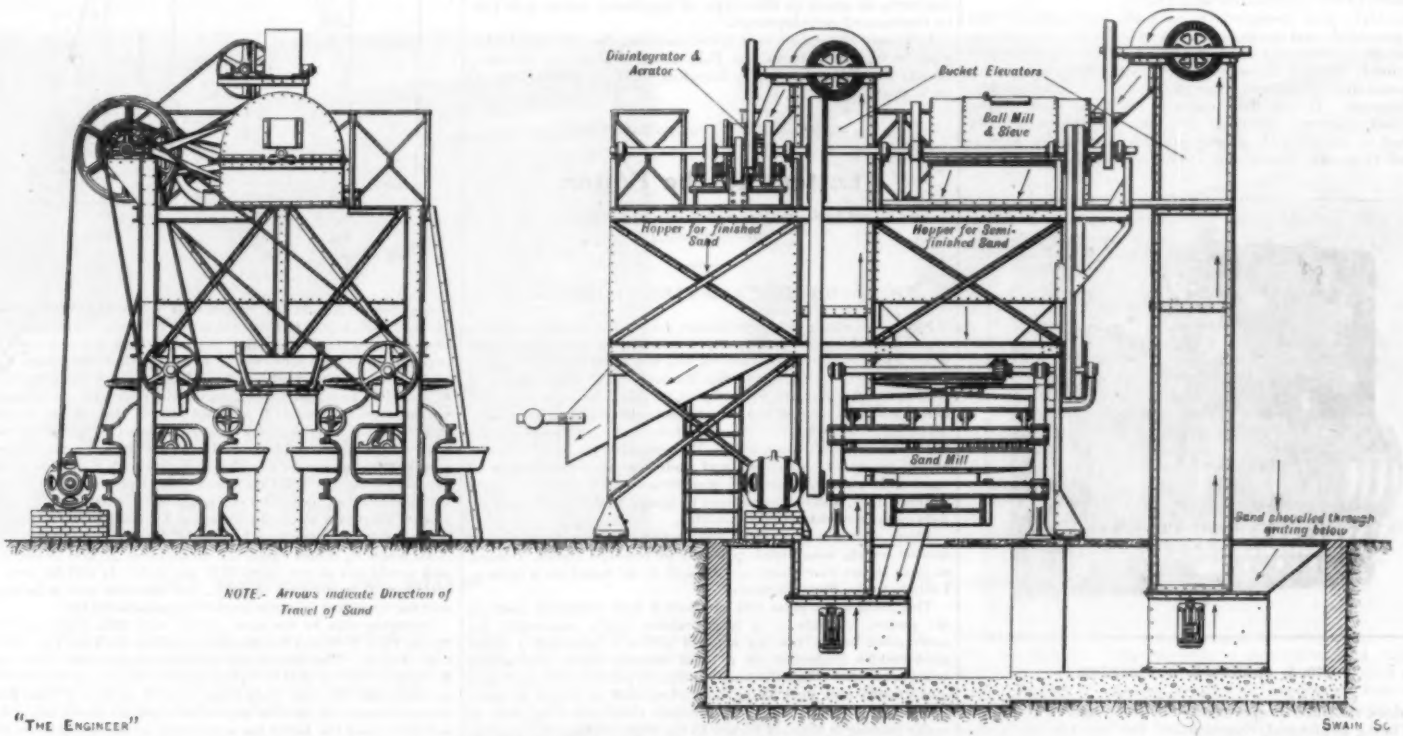
The plant is intended for re-conditioning green sand used in the foundry and avoiding the expense which is so frequently incurred in scrapping, entirely, sand which has been used in the moulds once and replacing it by new sand. For this purpose it is recommended that the sand should be mixed in the proportions of 88 per cent. of floor sand, 2 per cent. of coal dust, 2 per cent. of water and 8 per cent. of new sand. The various ingredients are all apportioned automatically in the plant.

The old sand, coal dust and new sand are shovelled into hoppers at the floor level indiscriminately, and valve-like devices in the several hoppers deliver the proper proportions of each. The hoppers are guarded by grids to prevent the entry of large pieces of foreign matter. An elevator then raises the material to the top of the plant and discharges it into a ball mill. In this mill there are several large cast iron balls, running in special races, which break up any lumps of sand, while a riddle separates anything that is not crushed and disposes of such material down a shoot leading to the floor level. The sifted sand drops out of the ball mill into a hopper below, and is then known as semi-finished sand, as it is, of course, still quite dry.

As the sand is required, it is discharged from the hopper into a pan mill below for the addition of the necessary water. In this mill the sand is subjected to the action of two rolls, one of which is provided with V-shaped cutting edges, while the other is plain. The water is sprayed over the surface, and it is noteworthy that while the sand is dry it will not pass the rolls, merely piling up in front of them. As soon, however, as the proper amount of water has been added, the sand starts working, and the supply of water is cut off. The pan of the mill is about 6ft. 10in. in diameter, and is machined all over on the inside. It is supported between two cast iron girders by a ball thrust bearing and is driven by gearing arranged overhead and consequently free from the abrasive action of the sand. The two rolls are hung on links from the upper girder at such a height that they cannot touch the bottom of the pan, as their function is to mix the sand and not to crush it. Harrows are provided for stirring up the sand and preventing it sticking to the bottom of the pan, while a scraper prevents the grooves in the channelled roller from becoming choked. It is generally necessary to make only seven or eight revolutions of the pan to prepare the sand, and a scraper is then lowered into position to plough out the sand through an opening in the centre. The pan can be almost completely cleared in a revolution.

The discharge from the pan mill is led into the boot of a second elevator, which raises the sand to the top of the plant again and delivers it to a disintegrator. The disintegrator takes the form of two pairs of discs rotating at a high speed in opposite directions, one within the other. Each pair of discs is connected together by a number of axial bars, and the sand, urged outward by centrifugal force, is thoroughly broken up and aerated by impact with these bars. There is naturally a tendency for the sand to adhere to the casing of the disintegrator, so the machine is given a jerky motion by an excentric to shake the sand off. From the disintegrator the sand falls into a second hopper and is then ready for the moulders.

These plants are made in several sizes ranging in capacity from 3 up to 50 tons per hour. That shown in the drawing will deal with 5 tons of sand per hour.



ARRANGEMENT OF FOUNDRY SAND RENOVATING MACHINE

INDICATING AMMETERS, VOLTMETERS, WATTMETERS, &c.

This revised specification, issued by the British Engineering Standards Association, is more complete than the 1919 issue, which is now superseded by the new edition. It provides for instruments having sub-standard first and second-grade accuracy, and among the additions the following may be specially noted:—A clause has been included to provide for satisfactory damping. The table of accuracies has been amplified, and, in common with most of the clauses of the specification, exhibits a tendency to make the requirements more stringent. The new specification provides for a dynamometer wattmeter having special accuracy, this having been introduced for use particularly in acceptance tests of electrical machinery. A clause has also been inserted specifying tests for wattmeters and power factor meters for use on unbalanced three-phase loads.

An Appendix deals at length with the accuracy to be expected of different types of instruments, a subject upon which but little information has hitherto been available. Suitable methods of testing instruments are also dealt with. Another Appendix gives the drilling centres recommended for shunt ends, these recommendations being based upon recent research which has shown that a large contact area is not in itself a sufficient criterion.

A very complete scheme of Terminal Markings has been drawn up with the object of insuring uniformity in diagrams of connections issued by different makers. A further point of interest is the note in the specification which draws attention to the fact that British manufacturers may be licensed to use the trade mark "B.E.S.A." to indicate that the instruments are guaranteed to comply with the specification.

Copies of the specification (No. 89, 1926) may be obtained from the B.E.S.A., Publications Department, 28, Victoria street, S.W. 1, price 1s. 2d., post free.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Birmingham Quarterly Meeting.

The autumn quarterly meeting of the Midland Iron Trade which was held at Birmingham on Thursday, though well attended, produced very little business. Producers of iron and steel in this district have, for the most part, been rendered idle by the disastrous struggle in the coalfields, and being unable to discern any prospects of securing, in the near future, sufficient supplies of suitable fuel—at the right price—to enable them to resume operations, they did not encourage the placing of forward contracts. Many of them have considerable orders on their books already—enough to last for some months—and they fear to add to their commitments. Moreover, there is no knowing how prices will move in the interim. Consumers, on their part, were looking for supplies to meet current needs, but there was little material to be had, and prices were so high that many users refused to compete for supplies, maintaining that with raw material at such a figure profitable manufacture is impossible. The last quarter of the year is normally a quiet one, but if the work which has been held up by the strike can be resumed, the demand upon producers of raw materials this quarter should be greater than has been the case since 1918. Practically all the Midland engineering works, heavy and light, are well off for orders, and they are anxious to commence work which, in some cases, has been on their books for months, but which it has been deemed unwise to commence with the industrial situation as unsettled as it has been since April last. A certain note of optimism was to be noted in many circles on 'Change. It was held that the end of the coal strike is now almost in sight, and with a return to normal output from the pits, the wheels of industry will begin to revolve once more, the furnaces be put into blast, and material will be forthcoming in sufficient quantities to enable manufacturers and engineers to make up some of the ground which has been lost. At the time of writing there has been no material change in iron and steel values. Prices have been for many weeks now more the subject of individual negotiation than conforming to any set basis, and any adjustments which might be made would not materially affect the market, but merely bring official quotations more into line with present market values.

Staffordshire Iron Trade.

Staffordshire ironmasters at Thursday's quarterly meeting reported that in the finishing mills they were better placed for orders than they had been at this time of the year for several years past. They spoke of very large production when coal supplies are available. Certain well-known firms in this district are stated to be booked well into the new year, while it is known that, as soon as operations are resumed at the mills, a considerable volume of new business will be forthcoming, with more to follow when timid consumers are satisfied that prices have settled down. Ironmasters state that there is a very large quantity of fuel available at the moment, but that its quality is hardly reliable, while its continuance in abundance is open at the moment to debate. They will, however, take the earliest opportunity to get the mills at work again. A few bars are being rolled in the district, but they do not come on to the market, as they are being supplied to customers whose claims are so great as to warrant no denial. The prices paid are subject to special arrangements. The advance of £1 in the price of Yorkshire bars is regarded here as a basis for orders to be put in hand when a general resumption becomes possible. It makes the price for Crown bars £12 10s. In Staffordshire it is not felt that any re-declaration would be useful. Lancashire houses are entering orders on their books for execution when circumstances admit, but the price is left open. Continental nut and bolt iron is coming into the district in increasing quantities, despite the fact that, for new business, prices have advanced considerably during the past week or two. Early delivery cannot now be made, the continental works being, according to merchant's reports, exceedingly full up. Nevertheless, Black Country manufacturers of bolts and nuts continue to place orders, for they have a good deal of work on hand, and there is every indication of their being busy for the remainder of this year. While at the same time there is little prospect of their being able to get Staffordshire bars at anything like the figure they are paying, even now, for continental. The quality of the foreign material is not admittedly up to that of local rolled material, but it is answering the purpose fairly well, and engineers generally do not complain.

Idle Blast-furnaces.

The opening of the third quarter of the year finds the blast-furnaces in the Midlands still idle, and with no immediate prospect of being blown in. Though there is a veritable famine in raw iron, such are the conditions existing in the fuel world to-day that furnace owners can only look on while foreign rivals gather in the orders which consumers would far rather give to local firms, but which circumstances compel them to deal with otherwise. The demands of late made on the few furnaces which are blowing in Cleveland, Durham and Scotland have been such that they could not possibly be coped with, and consuming industries are in many cases idle to-day owing to their inability to procure the raw material necessary. Look where they will, either at home or abroad, users cannot procure immediate supplies except at fabulous prices, but they hesitate to place forward business abroad, hoping, as they have hoped for months past, that ere long the furnaces at home will be blown in again, and that they will be able to satisfy their requirements at prices which will allow them in turn to produce at a profit. Notwithstanding the high price to which pig iron has advanced, there are many foundries in the Midlands which still remain active. On 'Change to-day Cleveland quotations advanced to £6 11s. for No. 1, and £6 8s. 6d. for No. 3 delivered Birmingham. This was taken by many Midland consumers to mean that the Cleveland smelter desired to withdraw from the market for the time being. Midland foundrymen have this week been paying round about £6 6s. for Scottish iron. Small quantities of foundry iron from a Durham furnace are coming into this district, and further consignments have been arranged for on the understanding that they will be available in six or eight weeks. The price for No. 1 was £5 16s. 3d. and for No. 3 £5 11s. 3d. It was reported at to-day's quarterly meeting that supplies of hematite are now quite exhausted. Few transactions in this material were accordingly effected. Continental foundry pig was on offer at about £3 16s. Merchants asked £5 per ton delivered Birmingham.

Insistent Steel Demand.

The call for all classes of steel continues unabated, and an increased number of engineering works are being held up for the want of necessary girders, &c. Boilermakers are experiencing great difficulty in procuring supplies of plates, while billets of native make are unprocurable. It is regarded as extremely unfortunate that the efforts which have been made to increase the output of British steel have been only moderately successful, some plants which have restarted in other districts having been forced to close down again on account of fuel trouble. A few mills are re-rolling in this district, but the results are not considered satisfactory, and many concerns are still maintaining their policy of idleness, until the ordinary coal is available in the usual quantities. The prices of British steel have steadied a little, but more firms are now closing their books to new business in the absence of enlightenment on future supplies and prices of coal. At the quarterly meeting of the Midland iron trade a few steelmasters expressed their readiness to sell forward on the basis of £7 15s. for angles. This applies, of course, to deliveries after the coal mines are in full working again, £1 more being required for early execution. Small steel bars were generally quoted at £8 15s. Foreign steel has become very expensive. Prices of continental half-products and finished material continue to stiffen. Joists were quoted this week at £6 16s., angles and bars at £6 18s. 6d. The price of billets worked out at £6 5s. to £6 6s., and blooms £6, delivered into the district.

Galvanised Sheets.

The demand for galvanised sheets, both from home and abroad, remains active. The chief difficulty at the moment is to secure adequate supplies of sheet bars even at the enhanced price now demanded, alike by home and foreign producers. Most of the mills are working at full pressure, but a curtailment of output is threatened in some cases. Quotations remain steady, 24-gauge corrugated sheets commanding from £16 15s. to £17 per ton.

Fuel Supplies.

The Coal Emergency Order, which gives a preference over industry to domestic and other users, is seriously hampering iron and steel constructional work, and, unless modified, may bring the operations of certain large building yards to an end. The few mills still at work are also feeling the pinch, while in the local tube trade severe curtailment of output is spoken of as likely. Coke is very scarce and dear. The difficulty of getting supplies is worrying galvanisers, small foundries, and various branches of the metal trades. In spite of the difficulty, however, they seem to be carrying on.

Works Extensions.

That Darlaston manufacturers and engineers are anticipating a boom in trade when the coal dispute is ended and the country resumes work on normal lines, is shown by the reorganisation and extension of works premises, which is at the moment being undertaken. In the nut and bolt industry and also in the structural ironworks and bridge building establishments, this movement is in evidence. In this connection considerable interest has been manifest recently in a number of heavy stamping blocks being used in extension work at the establishment of Garington and Sons, Ltd., one of the several large firms in the Guest, Keen and Nettlefold combine. These huge blocks, some weighing up to 80 tons apiece, are said to be unique inasmuch as each one consists of one solid piece. Two powerful traction engines were necessary to deliver the largest from the railway siding to the firm.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

A Skeleton in the Cupboard.

Both Manchester and Salford have for long been extremely sensitive about the river Irwell, which serves a useful purpose as a well-marked boundary between the two cities, but which otherwise is regarded as a nuisance, more particularly where it skirts the business area of Manchester. Pleasant as the Irwell may be at its source, by the time it reaches this hive of industry, it has brought with it a large quantity and variety of industrial waste products which has led to the more or less truthful appellation to it on more than one occasion of an "open sewer." Various suggestions have been put forward, one being to roof in the river where it runs through the business area and utilise the spacious "roof" for building purposes. From being an eyesore, the river might, out of sight, develop a dignity which citizens of Manchester and Salford might recognise with a certain amount of pride. That, however, will probably not be the way out. The latest idea is to divert the river, and at a meeting of the Salford City Council last week authority was given to secure expert advice upon the engineering and legal aspects of the question. The view of the city engineer is that there are no engineering difficulties in the way, but the chairman of a special committee which has had the matter under consideration explained that there might be legal difficulties, and that the committee wished to know the exact position before advancing the project farther.

A Question of Cables.

A recommendation of the Electricity Committee of the Salford Corporation that a Dutch tender for the supply of cables, amounting to £1062, be accepted, has been approved by the City Council after a good deal of discussion. As an amendment, it was moved that the Committee should accept the tender of £1248 submitted by a local firm—W. T. Glover and Co., Ltd., Trafford Park—on the ground that if the policy of accepting foreign tenders were carried on indefinitely, "the British cable-making industries would probably be closed down, with the result that continental cable manufacturers would increase their prices."

The General Outlook.

In the course of a general review of the position of the principal industries of this area during the past month, the Manchester Chamber of Commerce *Record* says: "The engineering trade has suffered from lack of materials since steel-making became greatly reduced during the coal stoppage, and, as it was known to be in that position, inquiries with a view to contracts have not been numerous. Constructional engineers and crane makers would ordinarily have been busy, but under present circumstances their activities are restricted, unless they are able to import supplies. Textile machinists and machine tool makers have had a poor time for similar reasons, although one large firm is reported to have received big orders from China and Japan. Locomotive builders and the heavy electrical trades have been fairly well supplied with orders and have endeavoured to get on with them."

Non-ferrous Metals.

The non-ferrous metal markets during the past week have displayed a weak tendency, even tin losing ground slightly, although the loss was recovered in the early part of this week. Sales of tin have been on a fair scale, and the position of the metal from a statistical point of view is regarded as quite sound, and no serious fall in values is anticipated in the near future. The demand for copper has been restricted, and with a period of heavy selling the market for this metal at one time was seriously affected, although the close was better, and at the time of writing the feeling is rather steadier. The cable-making industry has not been buying to any important extent, and the demand for manufactured copper under the existing conditions is on a relatively small scale. Transactions in both spelter and lead have also been restricted, and these sections closed on lower price levels than those of a week ago. At the moment the tone in both spelter and lead seems to show signs of improving, and price tendencies are certainly rather steadier. It is doubtful in either case whether there can be much serious decline in values, as these are already regarded as being at comparatively low levels.

Iron.

The iron market here during the week seems to have reached as closely to famine conditions as it can possibly do. For prompt delivery there is virtually nothing on offer, the only foundry iron obtainable for immediate delivery being a little Scottish No. 4, which was offered at about 117s. 6d. per ton delivered, and some continental iron at up to £5 5s. per ton. Scottish No. 3 for delivery in about a month's time is over £6 per ton delivered, and on the basis of current values of Cleveland No. 3 on the Middlesbrough market, the delivered price in this district would certainly be no lower than £6 10s. per ton, with no prospect of securing supplies before November. The makers explain these high prices by the cost of continental fuel and its relatively lower value, but it is certain that none but the most needy users are prepared to buy at these figures, and then only for early consumption. Of Midland counties iron there is no sign, and there is no likelihood of the production of this being resumed until steady and ample supplies of British fuel are to be got. Moreover, until that stage is arrived at and blast-furnace owners are in a position to estimate costs they are very unlikely to resume quoting. The Lancashire Bar Iron Association has increased the price of its products by a further 10s. per ton, making Crown bars £12 and second qualities £10 15s. There is very little to be bought, however, as none is being made and stocks have been virtually exhausted.

Steel.

Quotations for continental steels have been climbing steadily upward since the hesitancy, arising from the formation of the Steel Cartel, referred to last week. Siemens plates are now quoted at about £7 10s. per ton, light plates at £7 5s., billets at up to £6 5s., sheet bars at £6 12s. 6d., joists and sections at £6 15s., and steel bars at about the same figure, these prices being for cash against shipping documents, and including delivery to buyers' works in the Manchester district. It is patent, however, from inquiries this week that the buying of continental steel has slackened off appreciably, the high prices now current, the uncertainty of deliveries, and the prospect of home supplies coming on to the market, all being important factors to be taken into account. It is expected that at the beginning of next week plate rolling will be resumed at one big works where for several weeks now joists and sections have been produced on a restricted scale. Where prices are available for forward delivery there are wide variations in some cases, joists and sections ranging from £7 12s. 6d. to about £8 per ton, light plates at £8 5s. to £8 10s., and basic steel bars at £9 5s. to £9 10s. Galvanised sheets are steady at £17 per ton f.o.b., for the usual Indian specifications, and latterly a rather better feeling has developed in that market, inquiries and actual business being on an improved scale.

Scrap.

Supplies of non-ferrous metal scrap on offer are ample, but there has been little actual buying. Brass rod turnings, for sorted and graded materials delivered to

users' works, are quoted at £39 to £40 per ton, selected gunmetal scrap at £53, clean light copper £56 10s., braziery copper £52, lead £31, zinc £25 to £26, selected heavy yellow brass £45, and cast aluminium £80.

Two Large Transformers.

An interesting sight was witnessed last Friday when Ferranti, Ltd., of Hollinwood, transported two power transformers, each weighing 25 tons, by two traction engines through the city, *en route* for the Manchester docks. These transformers form part of a contract for twelve transformers, capable of dealing with a total of 250,000 horse-power or 186,000 kilovolt-ampères at 120,000 volts, which have been made for the Tata Power Company, Ltd., for its new power station at Bhira, India. It was appropriate that this proof of Manchester's ability to supply the needs of the British Empire should have been given during Civic Week.

The Manchester Association of Engineers.

The syllabus for the 1926–1927 session of the Manchester Association of Engineers, which has just come to hand, embraces some very interesting meetings. The list of papers includes an opening address by the President, Sir Benjamin Longbottom, M.I.E.E., M.I. Mech. E.; a paper on "Steel Works Machinery," by Mr. James Smith, on November 12th; and papers by Mr. H. P. Stevens and Mr. B. D. Porritt, on "Rubber and its Application to Engineering," and by Mr. S. B. Howden, M.Sc., entitled "The Junior Technical School and its relation to Engineering." On February 11th, Mr. C. le Maistre will present a paper on "The Work of the British Engineering Standards Association"; on February 25th, "Recent Developments in Machine Tools" will be dealt with in a joint paper by Messrs. G. E. Bailey, M.I. Mech. E., and Thomas Smith; while on March 11th the subject of "High-pressure Steam Generation" will be discussed by Mr. W. Bayliss, M.I. Mech. E. The final paper of the session will be on the subject of "Internal Combustion Locomotives," by Mr. G. E. Windeler, M.I. Mech. E. The opening meeting of the session will be held on Friday, October 22nd, when the President will present the Constantine and Butterworth Gold Medals for the best contributions to the papers and debates during last session. On the same evening the President will receive on behalf of the society a badge of office which has been presented by several of the ex-Presidents of the Association. The syllabus of the Students' Section, which opens on the 21st inst., contains an almost equally interesting set of papers. The chairman of the section is Mr. W. E. W. Millington, M. Inst. C.E., M.I. Mech. E., who will give an address on the opening night. On November 10th Mr. Henry Pilling, M.I. Mech. E., has promised to read a paper on "Deep Well Pumping"; on November 25th Professor T. H. Pear will discuss the "Human Factor in Engineering"; and on December 9th Mr. A. H. Goodgear will read a paper on "Welding." An open discussion on the "Link between Theory and Practice in Engineering" will take place on January 27th, and on February 10th a lecture will be given by Mr. J. P. Hallam, M.I. Mech. E., on "Manchester's Water Supplies." The final paper of the session is entitled "Properties and Uses of Special Steel," by Professor F. C. Thompson.

BARROW-IN-FURNESS.

Waiting.

The position in this district remains the same. All are simply waiting until fuel is again available, so that the makers may start on the orders which are held, and which, apart from any fresh orders that may be received, are sufficient to keep the furnaces going for a considerable period. In some cases the orders held total 100,000 tons. There seems no doubt that, once the works are active again, this district will experience better conditions than it has for a few years. There has not been any life in the pig iron trade for a long time, and the only spurt was when the present Government went into power. There was a brightening up then, but it was only momentary, and within a month the market was back again to its quiet state. Some people talk of a boom when the mines are working again, and fuel is obtainable at a price which will permit of iron being offered at a tempting price. It may be wrong to take that view, but it is safe to say that the prospects of a revival in trade are good to some extent. This revival may extend to the steel departments and also to shipbuilding. As regards shipbuilding, there are many rumours about, and one concerns the possible placing of the Argentine order for warships. It is understood that the competition for this work is keen and is not confined to this country. Germany is said to be out for the order, and it is possible that America will be in the market. There have been further arrivals of coal from America and the Continent, but it is expected that as the mines in this county turn out more coal the imports will dwindle.

SHEFFIELD.

(*From our own Correspondent.*)

Steel Trade Struggles.

THE steel industries of Sheffield and district are finding increased difficulty in carrying on, owing to the coal stoppage. Although there is a gradual growth in the quantity of open-hearth steel being made, employment on the heavy side generally is not maintained, and last week there was a substantial increase in the number of people drawing the unemployment grant. The latest firm to resume the making of steel is that of Cammell Laird and Co., who have started an open-hearth furnace at their Grimesthorpe works. But for the embargo on fuel, they would start another, and it is understood that Vickers Ltd. would be prepared to put several more in commission if the necessary fuel could be obtained. There have been several cases in which firms have curtailed their production on account of high costs. The majority are still able to get all the coal they want, but the rising costs of this essential intensify losses on sales, as it has only been possible to obtain very small increases in finished prices. There is a strong feeling that maximum prices of coal ought to be fixed by the Government under its emergency powers. The outlook is still considered favourable. The accumulation of orders, to be executed when the coal strike is at an end, has now reached large proportions, and the amount of business which Sheffield has lost owing to the trouble is not as large as might have been expected. The South Yorkshire Bar Iron Association last week advanced its prices £1 per ton, making the basis rate for Crown bars £12 10s. per ton net, delivered as usual.

Large Contracts.

Two capital contracts have been reported during the week. One was secured, in the face of severe continental competition, by the Staveley Coal and Iron Company, Ltd., and was for the cast iron pipes required in connection with the Cairo main drainage contract. The order comprises between 9000 and 10,000 tons of pipes, mostly of 46in. diameter. The value of the contract is something like £80,000. It will take about twelve months to complete, and will mean more employment for the company's workmen, who have not been working full time lately. Unfortunately, it will not be possible to start the work until the coal dispute is settled, as the firm is at present held up until it has sufficient coal to start the blast-furnaces. The second contract referred to has been placed by the London and North-Eastern Railway Company with Arnold and Co., of Doncaster. It is for the construction of a permanent branch railway, 3 miles in length, to serve the Stanton Iron Company's new colliery, which is in process of development at Bilsthorpe, in the Nottinghamshire coalfield.

Electricity Prices.

A few weeks ago I reported that the Electric Supply Committee of Sheffield City Council had recommended an increase in the price of current, on account of the greatly enhanced prices which it was having to pay for its coal. Electricity is largely used in Sheffield for motive power as well as for light, and it is unnecessary to say that manufacturers were not pleased at this proposed addition to their production costs. General satisfaction is now felt at the fact that the City Council, before whom the recommendation came last week, declined to confirm it. It was pointed out that the additional cost of fuel up to date was about £80,000, but the Council decided to carry on, for another month at any rate, without raising the charges. The Electricity Committee of the Hull Corporation has decided to increase its charges to consumers by 10 per cent. When the strike commenced, it had a reserve of coal, amounting to 12,000 tons, which was sufficient for three months, but since then it has had to purchase seaborne coal at a very heavy cost. The loss to the undertaking on account of the coal trouble is put at about £45,000, and the 10 per cent. increase will bring in about £5000 in the first quarter.

Leeds Engine Works Closing.

In view of the prevailing conditions of trade, Manning, Wardle and Co., Ltd., locomotive builders, of the Boyne Works, Leeds, have decided temporarily to close down. This step is not due directly to the coal strike or the labour situation, but to the existence of circumstances which have been in operation for some time adverse to English trade overseas. For some time past the firm has been working without profit. It is a very well-known firm, which has supplied locomotives to many places in South America, Africa and other parts of the world. The works are not going to be completely shut down, as a skeleton staff will be retained, quotations will be sent out, and in the event of orders being received the necessary workmen will be engaged. The plant will be maintained in good order, to await the better times which are confidently expected. In the meantime, about 400 men will be thrown out of employment.

Cutlery and Plate.

Very variable conditions prevail in the cutlery and plate trades, but there is little doubt that signs of improvement are to be observed, and there is a widespread belief in a general revival, although it may not occur in time to affect the present seasonal trade. The amount of Dominion business coming to hand at present is only moderate. In South America and elsewhere, depreciated exchanges are proving a hindrance to the expansion of purchases of good quality plate and cutlery. Several firms are developing lines of stainless cutlery to be sold at very cheap rates in markets where the people cannot afford to pay the prices asked for ordinary stainless knives. The quality will be good. The blades are being pressed out of the best stainless steel sheets, but the hafting will be done with cheap materials and by cheap methods.

Razors for the Navy.

The agitation against the action of the War Office in ordering safety razors from a firm outside this country is being strongly continued. The new Master Cutler, Mr. David Flather, on the occasion of his installation last week, made a strong protest against it. The Admiralty is out for a new supply of razors just now, but it has not followed the lead of the War Office in changing over to the safety. It is asking for tenders for 8400 razors of the old-fashioned type. The razors are to be of a much better quality than those formerly supplied to the soldiers, and are to be full hollow-ground. Contractors are asked to quote alternatively for machine and hand-made razors. The Admiralty is also asking for tenders for 6000 stainless table and cheese knives, with hard soldered handles, for the officers of the Fleet; 30,000 solid handle knives with nickel plated handles for the men; 5600 clasp knives, 24,000 unplated dessert spoons, 10,000 unplated forks, 1000 carvers and kitchen knives, and tools of many kinds. The Army is requiring 10,000 clasp knives.

Vickers and Australia.

A report was published last week from Melbourne to the effect that Vickers Ltd. intended to inaugurate an air service to encircle the Australian Commonwealth. The story proves to be rather premature. A representative of the firm, interviewed on the subject, stated that, while it was quite true that it was watching aerial developments in Australia, and was prepared to co-operate in starting an aerial service with the Australian Government and other interests, no move had yet been made.

A Six-wheeled Motor Omnibus.

That the Sheffield Corporation has no prejudice in favour of either tramcars or motor omnibuses was one of the points made by Mr. A. R. Fearnley, the general manager of the system, in a lecture which he delivered last week. He pointed out that at the present time schemes were in hand for extensions of both tramways and omnibuses, and that further extensions were waiting mainly for a period when capital would be available to enable track extensions to be undertaken at a reasonable cost. He mentioned a six-wheeled type of motor omnibus, which he anticipated would be in operation in the city and surrounding neighbourhood within the next few months. Only the limitation imposed upon finances by the coal dispute, he said, had prevented the earlier acquisition of this larger and improved type of vehicle.

Death of a Colliery Chairman.

The death occurred last week of Mr. W. D. Gainsford, of Skendleby Hall, near Spilsby, Lincolnshire, chairman of the Sheffield Coal Company, at the age of eighty-three. For a considerable time Mr. Gainsford was a prominent figure in Sheffield coal circles. He was an articled pupil to Messrs. Woodhouse and Jeffcock, mining engineers, Derby, and on the completion of his professional training, in 1863, he went to assist his uncle in the management of the Birley collieries, near Sheffield, which were then owned by a private company. Later, he took over the general managership, which he held until 1877, in the meantime becoming one of the owners, and afterwards holding the position of chairman for upwards of forty years. He was a magistrate, and, when he gave up the management of the collieries, he became a barrister, and practised for three or four years. He devoted much time to engineering and other mechanical pursuits.

NORTH OF ENGLAND.

(*From our own Correspondent.*)

Back to Work.

THE drift back to the pits is slow but sure, and there is a general belief in the North of England that very soon there will be a general resumption of work. Apart from a few small collieries in the remote parts of Northumberland and Durham, which have never stopped winning coal since May, there are a number of other and larger pits elsewhere in both counties which have reopened or are in process of reopening. Broomhill pit is now well away with coal-getting, and during the next few days it is expected that other collieries will follow suit. Preparations for a restart are also well advanced at the Preston Colliery, North Shields. In these areas, as well as in others, the feeling is prevalent that, as there seems little or no prospect of a national settlement, the time has arrived for obtaining the best terms possible locally and getting back to work. There is also in the minds of many miners the certainty that some thousands of workers who came out of the mines last May will never get back again. A significant move has been made by the Northumberland men this week. Not only have they rejected the idea of withdrawing safety men from the mines, but have passed a resolution which, if accepted by the rest of the coalfields, may go a long way towards district settlements—a method long since regarded by those who have studied all aspects of the industry as the most practical way out of the present deadlock. The men's Council passed a resolution asking the Miners' Federation to lay down certain principles, and to request the districts to make their settlements within those principles. This is certainly a way of getting to closer grips with the essentials of the problem.

Cleveland Iron Trade.

Pig iron prices continue to soar. Since my last letter there have been two successive advances of 2s. 6d. per ton in the price of Cleveland pig iron, and the standard No. 3 quality is now quoted at 117s. 6d. per ton; No. 1 foundry iron becoming 120s.; No. 4 foundry, 116s. 6d.; and No. 4 forge, 116s. These are phenomenal figures, but there are consumers who are still prepared to buy, but even at these prices they cannot get delivery earlier than November, all the October output being already sold. That consumers are prepared, at such figures, to buy so far ahead is an indication of the extremity of their needs, and confirms the view that there will be keen competition for supplies whenever the blast-furnaces are re-lighted. Nearly all the autumn export trade has been secured by continental competitors, but resumption of production on a normal basis will no doubt be followed by home consumers placing orders for the fall of the year needs.

Hematite Pig Iron.

The position in the East Coast hematite pig iron trade has become very difficult. It is almost impossible to obtain a price for mixed numbers, neither makers nor merchants having any of this quality to offer. Nominally mixed numbers are about 87s. 6d. per ton, but the only hematite on offer consists of other grades of varying analysis. Some small parcels of iron of high silicon and sulphur content have been sold round about 85s. per ton, and a little of this material is still obtainable.

Ironmaking Materials.

There is no opportunity of business in foreign ore, and no imports are reported this week. Best Rubio ore is nominally 21s. 6d. per ton c.i.f. Tees. Blast-furnace coke is still quoted at from 47s. 6d. to 50s. per ton c.i.f.

Manufactured Iron and Steel.

Having regard to the difficulties to be encountered a fair output of steel is still maintained, and the

demand is so strong that substantial premiums are being paid. Heavy steel rails are about £8 5s. per ton; steel ship-plates and angles range up to £8 12s. 6d.; boiler-plates, £12; galvanised corrugated sheets, 24-gauge, £16 15s.; and black sheets, £11 15s. per ton.

The Coal Market.

The daily output of coal in Northumberland and Durham is slowly increasing, but, of course, amounts to a mere fraction of the local requirements. Prices are high, but sellers can readily dispose of all descriptions, and even smalls realise fancy prices, as several utility companies are taking all they can get hold of for the purpose of mixing with imported coals. Nominal prices for the export trade over the winter months range from 22s. 6d. to 25s., according to grade, for best gas or steams. The collieries of Northumberland are to take a common line of action with regard to the price of coal on the termination of the dispute. Agents of several of the collieries have already notified dealers that immediately the stoppage is ended, and during the following two or three months—until supplies are equal to the demand—the price of coal will be increased by as much as 10s. a ton. The reason given for this prospective advance in the price is that it is needed to meet the losses sustained by the collieries during the present stoppage of the mines. The price of coke, also, is to be increased by a proportionate amount. There is a continued brisk demand for imported coal, and merchants have no difficulty in clearing all available quantities for this month's actual deliveries. For November arrivals the inquiry is not so brisk, as consumers prefer to buy on a hand-to-mouth basis. Imported gas coals are quoted firmly at 48s. to 50s. per ton c.i.f. Bunkers are in steady demand, and there is a fairly good movement for steam qualities.

Blast-furnacemen's Wages Advanced.

According to the ascertainment issued by the Cleveland Ironmasters' Association this week, the average net selling price of No. 3 Cleveland pig iron during the past quarter was 83s. 5.92d. per ton. This price will not affect wages in the customary way under sliding-scale agreement, but by special arrangement between employers and men's representatives, blast-furnace men's wages in the North of England will be advanced by 3 per cent. during the current quarter. At the request of the men's representatives, the ironmasters have reverted to the original standard price contained in the wages sliding-scale of 1919, viz., 54s. per ton.

Tees Shipyard Closed Down.

The industrial disturbance which the coal stoppage has entailed in the North of England has been intensified by the closing of Smith's Dock Company's South Bank Shipyard. The firm has struggled along for some time past in a desperate endeavour to maintain the supplies of materials necessary to keep the yard going, but at last it has been beaten by the growing scarcity. The shipyard was, therefore, closed down on Tuesday for an indefinite period. Repair work, however, is to continue.

SCOTLAND.

(From our own Correspondent.)

Trade Outlook.

THE industrial outlook for the immediate future at least continues in a most indefinite state. The return of the miners to work in Scotland is slow, though perhaps steady, and a certain amount of satisfaction may be gained thereby, but the effect on the markets must be practically nil, as it is recognised that until a general lasting agreement is arrived at in the industry as a whole, the position generally cannot be established on a sound basis. Temporary agreements have proved useless, involving as they may at any moment the trade concerned in an upheaval detrimental to almost all markets alike. The present position of the steel, iron and allied trades in Scotland demands a settlement of the coal situation on a basis calculated to provide fuel on an economic level with a freedom from anxiety as to continuity of supplies. Fluctuating costs and irregular supplies practically eliminate the possibility of successfully surmounting the bogey of foreign competition, the effect of which is painfully evident in many districts. Therefore the return of the miners, otherwise than on a wholesale basis on stabilised terms over a period leaves the industries involved in a well-nigh hopeless position. On that assumption, therefore, despite the return to work movement on the part of the miners, the outlook for the winter months at least is far from hopeful.

Steel and Iron.

As has already been said, the slowly increasing output of coal has caused a more hopeful feeling, but some time must elapse before sufficient quantities are available to be of any industrial value, and only then if the price recommends itself to consumers. Until such a position is established there is little likelihood of the works at present closed down making a restart. Meanwhile, only a very small proportion of the plants are in operation, and foreign materials are mainly in use. Heavy steel is practically unobtainable. Steel sheet makers are maintaining a fair output of black and galvanised varieties, and some works have sufficient orders on hand to guarantee employment for some time ahead. Bar iron makers have few works in operation, and production is chiefly confined to steel bars manufactured from foreign billets. Business in pig iron is very restricted. Foundry qualities are almost unobtainable, even in small quantities, and the prices quoted are very high. Moderate quantities of hematite are being sold to North of England foundries.

Coal.

The demand for coal has fluctuated somewhat during the past week. Consumers are not disposed to purchase foreign fuel in anticipation of requirements, while importers will not commit themselves to foreign sellers unless against firm orders. Prompt shipments are difficult to arrange, and are diminishing, and the output from home sources does not supply the deficiency. Consequently, even with a fluctuating demand the available supplies are inadequate, and prices are maintained on a high level, as follows:—Silesian screened, 75s. to 80s.; unscreened, 72s. 6d.; Westphalian screened, 70s. to 75s.; unscreened, 70s., all per ton f.o.b. Glasgow, Grangemouth, Bo'ness or Leith. American unscreened, 70s. to 75s. per ton f.o.t. Glasgow. Westphalian foundry coke, 48s. to 50s. per ton f.o.t. Grangemouth or Bo'ness. Scottish patent fuel, 50s. per ton f.o.b. Glasgow, Grangemouth or Bo'ness, and 51s. per ton at Leith. Scottish screened coal, 70s. to 75s.; triping, 60s. to 65s.; and dross, 50s., all per ton in trucks at pit. About 40,000 tons of American coal arrived in Glasgow harbour at the week-end. Six vessels arrived, each carrying from 6000 to 8000 tons.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Outlook.

THE events of the past week or so have not improved the expectations held of an early termination of the stoppage of work in the South Wales coalfield. Optimism has rather given way to pessimism, not so much as it affects the position of the whole of the coalfields of the country, but as it concerns this district. It came as a great surprise, even to the miners in South Wales, that the resolution put forward from the delegate conference here relative to the withdrawal of the safetymen, &c., should have been adopted by the National Conference in London, though the decision was tempered by the action subsequently of the Conference to refer the matter back to the districts. No doubt the South Wales district will endorse the resolution; it can scarcely do otherwise, but even if the national executive, acting upon the results from all the districts, decides to call out the safetymen, little or no anxiety is felt so far as South Wales is concerned. Apart from the fact that the authorities are taking measures to deal with such a possibility, the genuine belief prevails that the majority of the safetymen will remain at their posts. The local miners' leaders have made the claim that about 80 per cent. of the safetymen belong to the Miners' Federation, but that is strongly disputed by the officials of the Craftsmen's Association, who state that the Miners' Federation does not represent 50 per cent. of the safetymen. The Executive Committee of the South Wales and Monmouthshire Enginemen, Boilermen and Craftsmen's Association met at Cardiff on Tuesday to consider the position, and it issued instructions to all its members that they must pay no attention whatsoever to any request made for the withdrawal of their labour from the collieries.

Miners at Work.

It is computed that altogether there are about 16,000 miners actually at work throughout the whole of the South Wales coalfield. That is a fairly good number, though, in relation to the figure prevailing when work is at full swing, it is comparatively small. The drift back is very slow, and there is no doubt that hundreds of men are held back by the intimidation of the extremists. No doubt workmen will continue to go back, but at the moment no big breakaway is looked for, and grave fears are held that South Wales will be the last to see a general resumption of work. Those engaged in the coal export trade are not feeling at all comfortable about the position, because they fear that if other coal districts get started first they will secure the bulk of the good business that may be going.

Coal Imports.

The importation of coal from the Continent and America continues on a very heavy scale, but the supplies are not adequate for requirements. Several of the big industrial undertakings in this district have had a very difficult time owing to the shortage of supplies, and have only narrowly escaped having to suspend operations. There were close on twenty steamers discharging cargoes at local ports in the early part of this week. The Great Western Railway Company is a big receiver of supplies of American coals, and it is understood that it has on the way about a quarter of a million tons, while the Government has arranged for about 50,000 tons for this district. A fair quantity of continental coals is coming to hand, but fresh business is extremely hard to carry through, since prompt cargoes are almost unobtainable. Westphalian unscreened is quoted at about 54s. to 55s. c.i.f. and Westphalian large at about 60s. for delivery towards the end of this month, while American run of the mine is offered at round about 48s. to 51s. c.i.f. Coals are, however, so scarce, especially for bunkering, that many shipowners are in a quandary if they have any steamers in this district. It is practically impossible to put a price on coals for bunkers at South Wales ports, as coals are unobtainable, while at other ports in the United Kingdom bunkers command anything up to 75s. per ton. Even at ports on the Continent shipowners are asked up to 50s. per ton, so that it is not surprising that rates of freight are advancing every week in the short trades owing to bunker coals being so dear.

Works Resuming.

The Mannesmann Tube Works, Landore, near Swansea, restarted operations on Monday with supplies of foreign coals, and they hope to be able to maintain work, as they have sufficient coals, it is estimated, to last to the end of the coal stoppage. Messrs. Baldwins, King's Dock Works, Swansea, were also expected to resume work on Wednesday of this week, which means that thirteen mills, employing about 700 men, will be engaged.

Miners' Official Suspended.

Mr. Howell Rees, checkweigher of Coytrahen Colliery, a former chairman of the Garw district of miners, was suspended on Monday at a Garw district meeting of miners, as a delegate to the National Conference, the allegation being that he had called a ballot of the men at the Coytrahen Colliery, without sanction, on the question whether they would go back to work on a 45-hour week agreement.

Tramways Extension.

The Tramways Committee of the Cardiff Corporation contemplates a scheme for the extension of its system, involving a capital outlay of over £36,000.

LAUNCHES AND TRIAL TRIPS.

ALCANTARA, motor liner; built by Harland and Wolff, Ltd., to the order of the Royal Mail Steam Packet Company; dimensions, 655ft. 8in. by 78ft. by 45ft.; 22,000 gross tonnage. Engines, two Harland-B. and W. eight-cylinder, four-cycle, double-acting Diesel; constructed by the builders; launch, September 23rd.

MODAVIA, motor vessel; built by Vickers Ltd., to the order of the Donaldson Line, Ltd.; dimensions, 398ft. by 53ft. 6in. by 38ft. Engine, single four-stroke single-acting oil, with eight cylinders; constructed by the builders; launch, September 23rd.

NIDARNES, cargo steamer; built by Swan, Hunter and Wigham Richardson, Ltd. · to the order of Rederiaktieselskapet "Nidaros"; to carry 2200 tons deadweight. Engines, triple-expansion; pressure, 180 lb.; constructed by MacColl and Pollock, Ltd.; trial trip, October 7th.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

COCHRAN AND CO., ANNAN, Ltd., asks us to announce that it has changed the address of its London office from 7c, Lower Belgrave-street, S.W. 1, to 137, Victoria-street, S.W. 1. Telephone, 9341 Victoria (three lines).

MEDWAY'S SAFETY LIFT COMPANY, Ltd., of 1-2, Silex-street, Blackfriars-road, London, S.E. 1, asks us to state that it has secured the services of Mr. R. A. Evans, of Leicester, who will act as its provincial sales manager.

WALKER, CROSWELLER AND CO., of 54-58, Queen Elizabeth-street, London, S.E. 1, ask us to announce that they have been appointed sole British representatives of Lewis M. Ellison, of Chicago, U.S.A., the manufacturer of the Ellison inclined draught gauges for use on boiler and other power plants.

EDWARD G. HERBERT, Ltd., of Atlas Works, Chapel-street, Levenshulme, Manchester, England, asks us to announce that it has appointed Messrs. Innias and Riddle, Town Hall Chambers, 86, New-street, Birmingham, to represent it in the Midlands. Telegraphic address, "Powerful," Birmingham; telephone, 1425 Midland.

CONTRACTS.

STANDARD TELEPHONES AND CABLES, Ltd.—formerly the Western Electric Company, Ltd.—has received from the Danish Telegraph Administration an order to supply the equipment for a 5-kilowatt broadcasting station, which is to be erected at Kallundborg. The equipment will be manufactured in the company's London works.

TILLING-STEVENS MOTORS, Ltd., of 5, Iddesleigh House, Caxton-street, Westminster, London, S.W. 1, has received a repeat order from the Board of Fire Commissioners of New South Wales for one of its latest "All Power" motor turntable ladders. The machine is to be of the petrol electric type, and the ladder will reach to a total height of 87ft.

THE STREAM-LINE FILTER COMPANY, Ltd., of 64, Victoria-street, Westminster, S.W. 1, has received from the managers of the White Star Line an order for the installation of an oily-water separator in s.s. Majestic. In order to avoid encroaching on valuable space the separator has been specially arranged so as to use to the best advantage a space under the castings in the fan room. The filter will have a through put of 150 tons per hour.

THE INSTITUTION OF STRUCTURAL ENGINEERS.—To fill the vacancy caused by the death of Sir Charles Ruthen, the Council of the Institution of Structural Engineers has appointed as President Mr. Henry James Deane, consulting engineer, of Victoria-street. To fill the vacancy for a Vice-president caused by Mr. Deane's elevation, the Council appointed Mr. Ewart S. Andrews, B.Sc., A.M. Inst. C.E., consulting engineer, a partner in the firm of Messrs. Andrews and Beaumont, consulting engineers, High Holborn.

WATER LEVEL INDICATOR FOR GAUGE GLASSES.—There are almost as many devices for showing up the level of the water in a gauge glass as there are patented lock nuts. Yet another has just appeared, and it has this merit that it can be attached in a few minutes to any existing gauge glass. It consists of a painted metal rod about $^{5}/_{16}$in. in diameter, to which bright aluminium balls are fastened at intervals of 1in. Spring clips hold this device to the gauge glass itself. The optical effect of the water in the tube is to extend each ball into a broad silvery band, which is at once visible. The indicator is fixed behind the glass from the usual point of observation, but two or three indicators may be fastened to one glass if observation is to be made from several angles. We have tested this simple device and found it quite effective. But little illumination is necessary. The indicator is made by Pape and Benison, 22, Stanley-road, Barrow-in-Furness.

THE INSTITUTION OF CIVIL ENGINEERS.—The Council of the Institution of Civil Engineers has made the following awards for session 1925–1926 in respect of selected engineering papers, published without discussion:—A Telford Gold Medal and the Indian Premium to Mr. C. R. White, M. Inst. C.E. (London); a Telford Gold Medal to Mr. E. L. Everatt, Assoc. M. Inst. C.E. (Bombay); and Telford Premiums to Dr. B. Hague (Glasgow), Professor A. H. Gibson, D.Sc., M. Inst. C.E. (Manchester), and Mr. S. Labrow, Stud. Inst. C.E. (Bury) jointly; and Dr. W. J. Walker, Assoc. M. Inst. C.E. (Johannesburg); and in respect of papers read at students' meetings in London or by students before meetings of local associations during the same session:—The James Forrest Medal and a Miller Prize to Mr. D. S. Matheson, Stud. Inst. C.E. (London); and Miller Prizes to Mr. H. R. Lintern, Stud. Inst. C.E. (Shepton Mallet), Mr. R. D. Carr, Stud. Inst. C.E. (Cupar), Mr. C. Peel, Stud. Inst. C.E. (Frodsham), Mr. R. S. Bamber, Stud. Inst. C.E. (Leeds), Mr. N. R. Rice, Assoc. M. Inst. C.E. (Dar-es-Salaam), Mr. J. G. Kimber, Stud. Inst. C.E. (Eastbourne), and Mr. J. B. Mayers, Stud. Inst. C.E. (Birmingham).

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
Native	18/6 to 21/-
(1) Spanish	18/6 to 21/-
(1) N. African	18/6 to 21/-
N.E. Coast—	
Native	—
Foreign (c.i.f.)	21/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	4 12 6	—
No. 1 Foundry	4 15 0	—
No. 3 Foundry	4 10 0	—
N.E. Coast—		
Hematite Mixed Nos.	4 7 6	4 7 6
No. 1	4 8 0	4 8 0
Cleveland—		
No. 1	5 0 0	5 0 6
Silicious Iron	6 0 0	6 0 6
No. 3 G.M.B.	5 17 6	5 18 0
No. 4 Foundry	5 16 6	5 17 0
No. 4 Forge	5 16 0	5 16 6
Mottled	5 15 0	5 15 6
White	5 15 0	5 15 6
Midlands—		
(3) Staffs.—		
All-mine (Cold Blast)	10 10 0	—
North Staffs. Forge	3 17 6	—
" " Foundry	4 7 6	—
(3) Northampton—	(None offered.)	
Foundry No. 3	3 5 0 to 3 10 0	
" Forge	2 16 0 to 2 17 0	
(3) Derbyshire—	(None offered.)	
No. 3 Foundry	3 7 6 to 3 15 0	
Forge	3 2 0 to 3 5 0	
(3) Lincolnshire—	(None offered.)	
No. 3 Foundry	3 8 0	—
No. 4 Forge	3 5 6	—
Basic	3 6 0	—
(4) N.W. Coast—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 13 0 (a) to 4 19 6 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	11 10 0 to £12	11 0 0
Best	—	—
N.E. Coast—		
Common Bars	11 5 0	—
Lancs.—		
Crown Bars	12 0 0	—
Second Quality Bars	10 15 0	—
Hoops	14 0 0	—
S. Yorks.—		
Crown Bars	12 10 0	—
Best Bars	13 10 0	—
Hoops	14 10 0	—
Midlands—	(Prices nominal.)	
Crown Bars	11 5 0 to 11 10 0	
Marked Bars (Staffs.)	14 0 0	—
Nut and Bolt Bars	10 5 0 to 10 10 0	
Gas Tube Strip	12 10 0	—

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates	11 0 0	—
Ship Plates, ¾in. and up	7 17 6	7 0 0
Sections	7 7 6	6 5 0
Steel Sheets, under 3/16in. to ¼in.	11 5 0 to 12 10 0	
Sheets (Gal. Cor. 24 B.G.)	— £17 5 0 to 18 5 0	

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	8 12 6	—
Angles	8 12 6	—
Boiler Plates	12 0 0	—
Joists	8 0 0	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	8 2 6	—
Soft Billets	7 5 0	—
N.W. Coast—		
Barrow—		
Heavy Rails	8 0 0†	—
Light Rails	8 5 0 to 8 10 0	
Billets	8 0 0 to 11 10 0†	
Manchester—		
Bars (Round)	9 10 0	—
" (Small Round)	10 0 0	—
Hoops (Baling)	11 0 0	11 0 0
" (Soft Steel)	10 15 0	10 15 0
Plates	8 5 0 to 8 10 0	
" (Lancs. Boiler)	11 10 0	—
Sheffield—		
Siemens Acid Billets	10 0 0	—
Bessemer Billets	11 0 0	—
Hard Basic	8 12 6	—
Intermediate Basic	8 2 6	—
Soft Basic	7 5 0	—
Hoops	12 0 0	—
Soft Wire Rods	9 10 0	—
Midlands—		
Small Rolled Bars	8 12 6 to 8 15 0	
Billets and Sheet Bars	—	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	16 15 0 to 17 0 0	
Angles	8 12 6 to 8 17 6	
Joists	8 12 6 to 8 17 6	
Tees	9 12 6 to 10 17 6	
Bridge and Tank Plates	7 17 6 to 8 15 0	
Boiler Plates	11 0 0 to 11 15 0	

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	20/6 to 23/-
Block Tin (cash)	312 5 0
" (three months)	301 15 0
Copper (cash)	58 0 0
" (three months)	58 17 6
Spanish Lead (cash)	30 10 0
" (three months)	30 7 6
Spelter (cash)	34 2 6
" (three months)	34 2 6
Manchester—	
Copper, Best Selected Ingots	65 12 6
" Electrolytic	67 5 0
" Strong Sheets	90 0 0
" Tubes (Basis Price)	0 1 1
Brass Tubes (Basis Price)	0 1 0
" Condenser	0 1 2½
Lead, English	32 7 6
" Foreign	31 0 0
Spelter	34 10 0

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/9 to 1/10 per lb.	
Ferro Tungsten	1/4½ per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 0 0	7/6
" " 6 p.c. to 8 p.c. "	£22 0 0	7/3
" " 8 p.c. to 10 p.c. "	£20 15 0	6/6
" " Specially Refined		
" Max. 2 p.c. carbon	£37 0 0	12/6
" " " 1 p.c. "	£43 5 0	15/-
" " " 0·70 p.c. carbon	£54 0 0	17/6
" " " carbon free	1/5d. per lb.	
Metallic Chromium	3/- per lb.	
Ferro Manganese (per ton)	£15 for home, £15 for export	
" Silicon, 45 p.c. to 50 p.c.	£10 5 0	scale 5/- per unit
" " 75 p.c.	£16 0 0	scale 6/- per unit
" Vanadium	14/9 per lb.	
" Molybdenum	5/3 per lb.	
" Titanium (carbon free)	0/11 per lb.	
Nickel (per ton)	£170	
Cobalt	10/- per lb.	
Aluminium (per ton)	£112	

FUELS.

SCOTLAND.

	(Prices nominal.)	Export.
Lanarkshire—		
(f.o.b. Glasgow)—Steam		15/9
" " Ell		18/6
" " Splint		16/6 to 17/-
" " Trebles		15/9
" " Doubles		14/- to 14·6
" " Singles		13/9
Ayrshire—		
(f.o.b. Ports)—Steam		16/9
" " Jewel		17/- to 17/6
" " Trebles		17/-
Fifeshire—		
(f.o.b. Methil or Burntisland)—Steam		12/6 to 14/9
Screened Navigation		21/-
Trebles		14/- to 15/-
Doubles		14/-
Singles		13/- to 13/6
Lothians—		
(f.o.b. Leith)—Best Steam		14/- to 14/3
Secondary Steam		13/6
Trebles		14/6 to 14/9
Doubles		13/6
Singles		13/6

ENGLAND.

(8) N.W. Coast—	
Steams	*No quotation*
Household	" "
Coke	" "
Northumberland—	
Best Steams	16/-
Second Steams	14/6 to 15/-
Steam Smalls	8/- to 8/6
Unscreened	13/- to 13/6
Household	20/- to 22/-
Durham—	
Best Gas	18/6 to 19/-
Second	15/- to 15/6
Household	20/- to 22/-
Foundry Coke	18/- to 20/-

Sheffield—	Inland. (Nominal; none on offer.)
Best Hand-picked Branch	31/- to 34/-
Barnsley Best Silkstone	28/- to 30/-
Derbyshire Best Brights	26/- to 28/-
" " House	24/- to 25/-
" " Large Nuts	17/- to 20/-
" " Small	12/6 to 14/-
Yorkshire Hards	17/- to 19/6
Derbyshire Hards	16/- to 19/-
Rough Slacks	10/- to 12/6
Nutty Slacks	7/6 to 9/-
Smalls	3/6 to 6/-
Blast-furnace Coke (Inland)*	—
" " (Export)	f.o.b. 16/- to 17/-

(9) SOUTH WALES.

Cardiff—	(All prices nominal.)
Steam Coals :	
Best Smokeless Large	26/- to 27/-
Second " "	24/6 to 25/6
Best Dry Large	24/- to 25/-
Ordinary Dry Large	21/- to 22/-
Best Black Vein Large	25/6 to 26/-
Western Valley Large	24/6 to 25/-
Best Eastern Valley Large	24/- to 25/-
Ordinary " "	23/6 to 24/-
Best Steam Smalls	17/- to 18/-
Ordinary "	16/- to 17/-
Washed Nuts	19/- to 20/-
No. 3 Rhondda Large	26/6 to 27/-
" " Smalls	18/- to 18/6
No. 2 " Large	24/- to 25/-
" " Through	20/- to 21/-
" " Smalls	15/- to 16/-
Foundry Coke (export)	40/- to 50/-
Furnace Coke (export)	25/- to 30/-
Patent Fuel	42/6 to 45/-
Pitwood (ex ship)	32/6 to 35/-
Swansea—	
Anthracite Coals :	
Best Big Vein Large	39/- to 40/-
Seconds	32/6 to 35/-
Red Vein	27/- to 29/-
Machine-made Cobbles	47/6 to 50/-
Nuts	47/6 to 50/-
Beans	42/6 to 44/-
Peas	23/- to 25/-
Breaker Duff	7/6 to 8/-
Rubbly Culm	12/6 to 13/6
Steam Coals :	
Large	22/6 to 24/6
Seconds	20/- to 22/-
Smalls	11/- to 15/-
Cargo Through	16/6 to 17/6

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayreshire. (6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. * For blast-furnaces only, 17/-, with fluctuations according to analysis; open market 17/6 to 19/- at ovens. † Latest quotations available. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham.

French Engineering Notes.

(From our Correspondent in Paris.)

The Steel Cartel.

THE organisation of steel makers in the four principal producing countries on the Continent is being discussed in a way that denotes a certain indecision regarding the effects the operations of the Cartel are likely to have upon the industry. It is certain that the negotiations were carried through just in time to save the continental steel trade from serious trouble, brought about mainly by an over-production for export at a time when the foreign demand had become very restricted, and the fear of disastrous price cutting was responsible for the readiness with which the steel-making industry decided practically to divide up the business. The Cartel is received with favour because it is believed to be the beginning of a general reorganisation of European industries. The Steel Union is expected to be the nucleus around which will gather all the other metallurgical trades, and will insure their reconstitution on a normal and prosperous basis. It is quite possible that these hopes may be exaggerated, for the difficulties in the way of forming the Cartel show that much trouble may be experienced when efforts are made to conciliate the interests of manufacturers in other branches of the metallurgical industries. Still, the spirit of co-operation is very prominent just now, because everyone feels the necessity of pulling together at a time when individual effort appears powerless, and for a long while to come there will be talk of industrial combinations which are to form part of a general reconstruction. Nevertheless, the Steel Cartel is by no means perfectly safe. So far as France and Germany are concerned, its existence depends upon the carrying out of a treaty of commerce between the two countries, and, if negotiations for that treaty fall through, the Cartel automatically comes to an end. The risks of such a contingency are believed to be extremely remote, for it is regarded as of the first importance to hurry through with the treaty in order to insure the existence of the Cartel. While the steel makers are unanimous in their support of the Cartel consumers are nervous as to what will happen to them in the future, but, in a general way, they anticipate that their interests will be served by the stabilisation which will follow upon the operations of the new body, though the immediate effects have certainly not been favourable to buying.

Industrial Agreements.

The difficulty in the way of binding manufacturers to a definite agreement is seen in the results of the efforts to form a union of wire drawers and nail makers. The Belgians and Dutch first decided to meet periodically to discuss the situation and decide upon any course of action with respect to a distribution of orders and the fixing of prices. A similar meeting is now to be held between the Belgians and the French, after which there will be meetings between the Dutch and the Germans. All four countries will then endeavour to form a union, or at least to assemble at stated periods and decide upon production and prices, and it is even hoped that an organisation, which will bring in other industries, may be created. This movement implies that all the different industries are now grouping together and will eventually gather around the Steel Cartel. It is also extending to countries in Eastern Europe. That is one reason why everything is being done to consolidate the position of the Steel Cartel, upon which, it is believed, depends the future prosperity of the industry. The only element of uncertainty is the possibility of the influence of the Cartel being weakened by the abstention of British steel makers.

Eight Hours' Day.

As part of the reforms it is proposed to carry out in order to enable the country to recover its economical balance, an inquiry is to be made into the best way of adapting the legislation affecting working hours to the present condition of things. Everyone, except a small section of the community, appears to be of the opinion that the legislation must be rendered more elastic, and while the principle will probably remain intact, all sorts of facilities for contracting out will enable employers and their men to co-operate for a larger and more economical production. An inquiry will be made in each industry to ascertain exactly what is needed to increase production, and when that is done, works' inspectors will receive instructions as to the tolerances they can allow in working hours. There is a general impression that employers and their men will be allowed to arrange matters amongst themselves.

Coal Production.

The production of the French collieries during the first eight months of the year was 34,223,936 tons, which is equivalent to an annual output of 51 million tons, or two million tons more than in the previous year. If the rate be maintained the total will be the highest yet recorded. The increased production has done little to remedy the shortage of coal supplies arising from the British strike. It was believed that the stoppage of consignments from Great Britain would have been made up for by supplies from Germany and elsewhere, but the quantities available from those sources are small, probably on account of so much being sent to Great Britain. On the termination of the strike as much of that coal as may be required will certainly find its way to this country. Meanwhile, the situation is becoming critical, particularly in some of the ports, where it is almost impossible to coal coastal vessels. The result of these difficulties is that the French Government is causing an inquiry to be made into the possible sources of coal supply in the hope of rendering the country independent of Great Britain in the future.

THE INSTITUTE OF METALS.—We are informed that November 15th is the last date for the receipt of papers intended to be presented at the annual general meeting of the Institute of Metals, to be held in London on March 9th and 10th.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

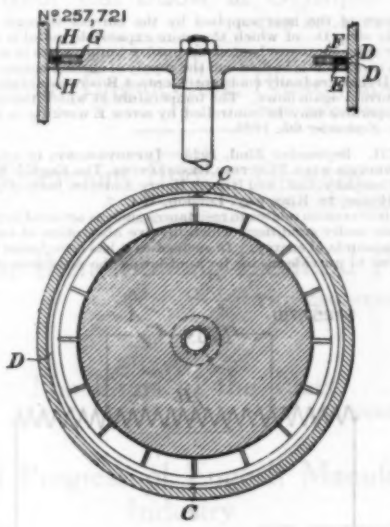
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM ENGINES.

257,721. August 7th, 1925.—IMPROVEMENTS IN OR RELATING TO PACKING FOR PISTONS AND THE LIKE, Robert Alexander Sturgeon, of 33, Church-lane, Brighouse, York.

The object of this invention is to provide an improved construction of packing adapted to form an efficient joint between the piston and the cylinder without causing undue friction when relative movement takes place between the piston and cylinder. D and D are metallic rings which are each divided, preferably in one place C, on the circumference. E is a round section non-porous rubber ring, whilst F is a number of separate metal sections fitted end to end, to form a ring, which is referred to as the the segmental ring. The rings all fit into the groove G in the piston, and are so arranged that the divided rings D D make contact with the inside bore of the cylinder, and are preferably

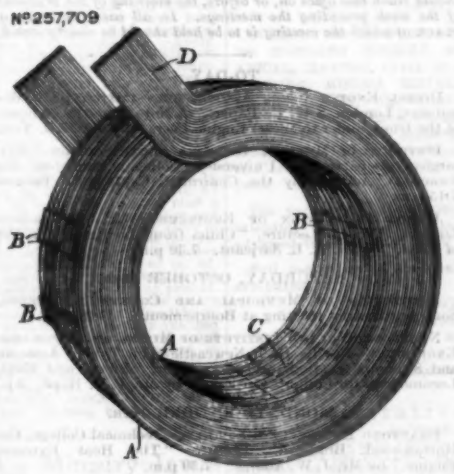


arranged with the divisions on opposite sides of the piston. The round section rubber ring E occupies an intermediate position, and the segmental ring F takes up the inmost position. When the cylinder and piston rotate rapidly, the centrifugal force acts upon the joint to cause it to expand. The divisions in the outer rings allow them to expand to make close contact with the inside bore of the cylinder. The segmental backing rings press hard on the intermediate rubber ring, causing it to make a tight joint along the line of contact, between the adjacent faces of the outer rings, and also to expand sideways to make a tight joint in the groove in the piston along the circular lines at H H. By this means a metallic joint in contact with the cylinder bore is obtained, and this joint is supported by a water-tight backing, which prevents leakage round the back of the metallic joint. An alternative scheme is also described.—*September 9th*, 1926.

TRANSFORMERS AND CONVERTERS.

257,709. July 13th, 1925.—IMPROVEMENTS RELATING TO THE ARRANGEMENT AND CONSTRUCTION OF THE WINDINGS OF ELECTRIC TRANSFORMERS, The English Electric Company Ltd, of Queen's House, 28, Kingsway, W.C. 2, and Reginald Morse Charley, of Siemens Works, Stafford.

This invention relates to an improved form of heavy current winding applicable to the sandwich type of arrangement, which permits each section to be made as a continuous cylindrical

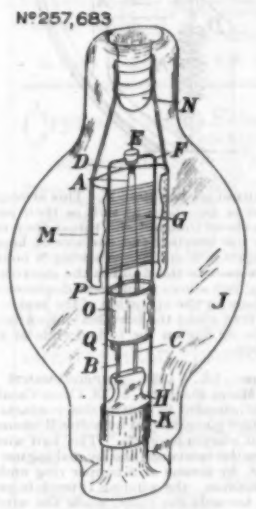


helix without joints between the ends. A section of the improved winding is made by taking a number of conductors sufficient to carry in parallel the current of the section, and by arranging these conductors to form a flat layer of the full radial width of the section, and then coiling this layer into a cylindrical helix or straight sided coil having a substantially central crossover of conductors, as shown at C. The individual conductors from which the winding is constructed will, in general, be connected in parallel at their ends, and may be insulated to a certain extent within the helix by giving the conducetors a covering of cotton or other insulation. The width of each flat layer of parallel connected conductors is equal to the radial width A A, and each conductor is composed of copper having a rectangular section with sides substantially equal to the width of each flat conductor in an axial direction. Some or all of the individual rectangular conductors are wrapped with insulation, as a means of preventing eddy currents, and the successive flat layers are insulated from one another by distance pieces B, which permit the circulation between the layers of the oil in which the coils are usually immersed. In making the central crossover C, the conductors are divided into halves, and the inner half is transferred to the outside of the coil, whilst the outside half is brought to the inside. This results in the inner and outer conductors of the layer laying in the middle of the layer. If, for instance, the layer consists of twenty-four conductors numbered from the outside to the inside consecutively, the arrangement before crossover would be 1 to 24, after crossover 13 to 24 and 1 to 12. By making a crossover in this manner the losses are reduced to a minimum. The ends D are bent outwards, so as to extend radially beyond the outer circumference of all the coils.—*September 9th*, 1926.

TELEGRAPHS AND TELEPHONES.

257,683. June 9th, 1925.—IMPROVEMENTS IN THERMIONIC VALVES, The General Electric Company, Ltd., of Magnet House, Kingsway, London, W.C. 2, and Albert Charles Bartlett, of Research Laboratories of the General Electric Company, Ltd., Wembley, Middlesex.

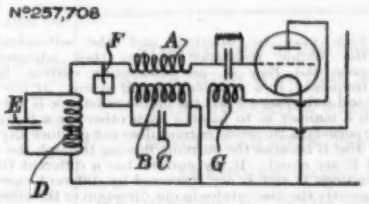
In the operation of transmitting valves, especially when several are connected in parallel, it frequently happens that undesired oscillations of very high frequency occur, and it has been suggested to overcome this difficulty by interposing auxiliary condensers, self-inductances, or resistances tuned to the undesired frequency in the valve circuit. In accordance with this invention the tendency for a valve to produce very high frequency oscillations is reduced by inserting within the envelope of the valve an auxiliary condenser connected electrically between the grid



and the cathode, the function of this condenser being, virtually, to short-circuit the grid and filament at the very high frequencies. A looped filament A, which may be of tungsten, with leading-in wires B and C, has its loop supported by a hook D carried by an insulator E attached to a frame F, on which the grid electrode G is arranged, the frame F being mounted on the foot-tube H of the evacuated envelope J by a clip K or in any well-known manner. The surrounding anode M, shown partly broken, is mounted on the opposite foot-tube N in a similar manner. An auxiliary condenser, consisting of two concentric cylindrical metallic plates O and P, is arranged below the filament grid anode system, the external cylinder O being connected with the frame F of the grid electrode, whilst the cylinder P is connected with one of the filament leads, *e.g.*, B, by a supporting wire Q.—*September 9th*, 1926.

257,708. July 9th, 1925.—IMPROVEMENTS IN OR RELATING TO THERMIONIC VALVE CIRCUITS, Igranic Electric Company, Ltd., of 147, Queen Victoria-street, London, E.C. 4, and Peter William Willans, of The Cottage, Pattishall, Towcester.

This invention relates to thermionic valve circuits, and in particular to those in which means are provided for neutralising capacitative and conductive coupling between two oscillatory circuits associated with the grid and filament circuit of a thermionic valve. In some thermionic valve systems it is desired to associate two oscillatory circuits with the grid and filament circuit of the valve in such a manner that, whereas an electromotive force can be introduced between the grid and filament from each of these circuits, the two circuits are not substantially coupled together either capacitatively or conductively as by way of the electron stream from filament to plate. The inven-



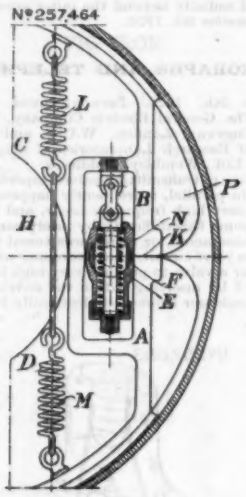
tion has for its object the provision of an improved thermionic valve system which will comprise two such oscillatory circuits and also means for neutralising the capacitative and/or conductive coupling between them. One of the transformers is an ordinary transformer, the primary winding of which is constituted by a coil A, and the secondary winding of which is constituted by a coil B. The other transformer is an auto transformer having both its primary and secondary windings constituted by one and the same coil D. The tuning condenser C for the former transformer is connected across the terminals of the coil B, and the tuning condenser E for the latter transformer is connected across the coil D. As shown, the coils A and B are connected in series between the grid and filament of the valve, the coil D being nearest the filament. The coil A is connected in series with the coil D and an impedance F, so as to form a closed circuit, the impedance F being connected to the grid end of the coil B.

When the arrangement is used in connection with a supersonic detector oscillator valve, the coil D may be the frame aerial. In this case a reaction coil G magnetically coupled to the coil A may be included in the anode circuit of the valve. A grid leak is also preferably employed.—*September 9th*, 1926.

MISCELLANEOUS.

257,464. December 3rd, 1925.—Improvements in and relating to Expanding Shoe Brakes, Guido Fornaca, of 7, Via Giannone, Turin, Italy.

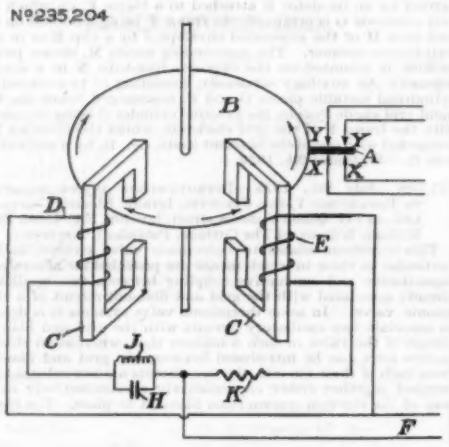
This invention relates to expanding shoe brakes of the kind in which the actual braking effort is created automatically by the rotation of the brake drum in either direction, when the shoes are expanded. The specification describes an improved arrangement for supporting and centring the shoes. A and B denote the fork-shaped ends of the brake shoes C and D supported by a bearing E capable of oscillating on the pivot F



secured to the fixed anchor plate H. This arrangement allows of a displacement of the shoes as well as their oscillation on the pivot F. The shoes transmit the thrust they receive from the drum through the bevelled end surfaces K kept in contact by means of the springs L and M. A spring N holds the two shoes centred with respect to the drum in the inactive position shown on the drawing, but allows a sufficient displacement of the shoes in both directions for the operation of the brake. During expansion the shoes turn about the bevelled end surfaces F. P denotes reinforcing ribs or fins on the forked ends of the shoes.—*September 2nd*, 1926.

235,204. June 4th, 1925.—Improvements in Electric Relays, Mario Fiachetti, of 38, Corso Casale, Turin, Italy.

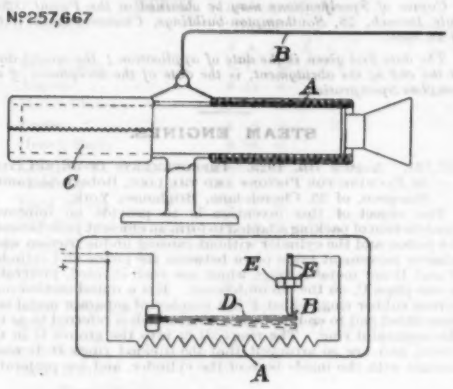
This relay is intended to control the contacts X X and Y Y and A is a contact piece carried by a disc B mounted between the cores C of two electro-magnets. The two windings D and E are mounted on the two cores, and by making use of known means—for example, by means of a copper ring embracing one-half of the pole extension—the winding D tends to produce a rotation of the disc B towards the right, while the winding E tends to produce a rotation in the opposite direction. The two windings are connected in parallel with a supply line F. In the winding D are inserted a capacity H and a self-inductance J, whilst in the winding E there is an ohmic resistance K. The capacity



H, which may be omitted, and the self-inductance J and the ohmic resistance K are then adjusted so as to oppose the flow of an alternating current having a given frequency, to a practically equal extent. If the capacity H, the self-inductance J and the ohmic resistance K are adjusted in such a manner as to balance each other for a frequency of, say, 20 periods, a 20-period current does not produce any rotation of the disc B because the currents flowing through the windings D and E are equal. If the current has a different frequency, the windings D and E are traversed by different currents and consequently the disc rotates in one direction or the other according as the frequency is higher or lower than 20 periods.—*September 6th*, 1926.

257,667. June 4th, 1925.—Improvements in or connected with the Heating of Scientific and Technical Instruments, Barr and Stroud, Ltd., and James Weir French, both of Caxton-street, Anniesland, Glasgow.

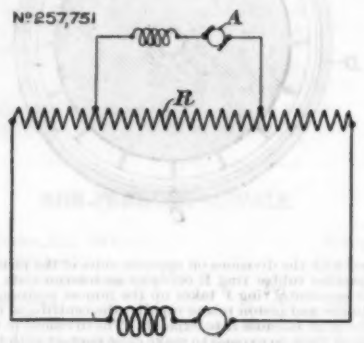
The invention refers to the heating of scientific and technical instruments. The instruments are provided with electrical resistance elements forming a covering through which current may be passed for heating the instruments, and generally provision may be made whereby current may be supplied or cut off as required. By means of a thermostat—or equivalent device—instruments may be maintained at a constant temperature somewhat higher than that it is liable to be subjected to under ordinary changes of atmospheric temperature. A telescope is shown provided with a wrapping comprising insulated resistance wires A, through which current is supplied by leads B. The wrapping may comprise a covering C. The wrapping provided may be such that the objective and eye lens of the telescope shall be well within the space where heat is applied, in order to prevent fogging, which otherwise might occur by the deposition of dew. The lower illustration shows one form of thermostat which may be employed. The current traverses the heating resistance A, then passes through the contact B and double strip D, and thence to the negative pole. Under the



influence of the heat supplied by the current through A the double strip D—of which the more expansible metal is on the upper side—becomes heated up until a temperature is reached when contact B is broken and the supply of current ceases. The strip D then gradually cools until contact B is re-established and the current again flows. The temperature at which the thermostat operates may be controlled by screw E working in a fixed nut.—*September 6th*, 1926.

257,751. September 22nd, 1925.—Improvements in and connected with Electric Resistances, The English Electric Company, Ltd., and Hubert Henry Andrews, both of Queen's House, 28, Kingsway, London, W.C. 2.

This invention relates to resistances such as are used in electric circuits under conditions which involve absorption of considerable amounts of energy. In such cases it has been found advantageous to provide means for ventilating the resistance through



the agency of a fan or blower. In accordance with the present invention the fan is driven by an electric motor A, which is so arranged that the voltage applied to its armature is dependent upon the current passing through the resistance R at any time, and in such a way that as the current increases the armature voltage will also increase, producing an increase in the speed of the fan, which results in an increase in the quantity of air flowing over the resistances.—*September 9th*, 1926.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

Diesel Engine Users Association.—Caxton Hall, Westminster, London, S.W. 1. Paper, "A Note upon the Obligation of the Ironfounder to Diesel Engine Users," by Mr. H. J. Young.

Institute of Metals: Swansea Local Section.—Metallurgical Department, University College, Singleton Park, Swansea. Address by the Chairman, Captain L. Taverner. 7.15 p.m.

Junior Institution of Engineers.—39, Victoria-street, London, S.W. 1. Lecture, "China from the Engineer's Point of View," by Mr. R. L. Sarjeant. 7.30 p.m.

SATURDAY, OCTOBER 16TH.

Institution of Municipal and County Engineers.—Southern District meeting at Bournemouth. 11.30 a.m.

North of England Institute of Mining and Mechanical Engineers.—Neville Hall, Newcastle-upon-Tyne. Associates' and Students' Section meeting. Paper, "Steam and Electric Locomotives for Colliery Purposes," by Mr. P. F. Hope. 3 p.m.

MONDAY, OCTOBER 18TH.

Bradford Engineering Society.—Technical College, Great Horton-road, Bradford. Lecture, "The Heat Extraction Engine," by Mr. J. W. Adams. 7.30 p.m.

TUESDAY, OCTOBER 19TH.

Institute of British Foundrymen: Lancashire Branch, Burnley Section.—Municipal College, Ormerod-road, Burnley. Paper, "Elementary Science for Practical Moulders," by Mr. A. Jackson. 7.15 p.m.

University of London.—University College, Gower-street, London, W.C. 1. Public lecture, "The Drainage of the Zuyderzee," by Mr. K. Jansma. 5.30 p.m.

WEDNESDAY, OCTOBER 20TH.

Institution of Automobile Engineers.—Chamber of Commerce, New-street, Birmingham. Birmingham Graduates' meeting. Paper, "Engine Lubrication," by Mr. W. Evans. 7.30 p.m.

Institution of Electrical Engineers: South Midland Centre.—Grand Hotel, Birmingham. Address by the Chairman, Colonel J. F. Lister. 7 p.m.

Institution of Fuel Economy Engineers.—Connaught Rooms, Great Queen-street, London, W.C. 2. Luncheon and address by the Right Hon. Sir Robert Horne, M.P. 1 p.m.

Newcomen Society.—Iron and Steel Institute, 28, Victoria-street, London, S.W. 1. Presidential address, "Observations on the Rise and Progress of Manufacturing Industry in England," by Mr. Rhys Jenkins. 5.30 p.m.

Society of Glass Technology.—Coal, Gas and Fuel Industries Lecture Room, The University, Leeds. General discussion on "Annealing of Glass." 2.30 p.m.

Society of Technical Engineers.—102, Belgrave-road, London, S.W. 1. Address by the President, Mr. C. T. Inman. 7 p.m.

THURSDAY, OCTOBER 21ST.

Institution of Civil Engineers: Yorkshire Association.—Hotel Metropole, Leeds. Address by the Chairman, Mr. E. J. Silcock. 7.30 p.m.

Institution of Electrical Engineers.—Savoy-place, Victoria Embankment, London, W.C. 2. Presidential address, by Dr. W. H. Eccles. 6 p.m.

Institution of Mechanical Engineers: North-Western Branch.—The Engineers' Club, Manchester. "Natural v. Artificial Fuels," by Professor W. H. Watkinson. 7 p.m.

Royal Aeronautical Society.—Royal Society of Arts, 18, John-street, Adelphi, London, W.C. 2. Lecture, "Notes on Magnesium and Some of its Alloys," by Mr. W. R. D. Jones. 6.30 p.m.

FRIDAY, OCTOBER 22ND.

Institution of Mechanical Engineers.—Storey's-gate, Westminster, London, S.W. 1. Presidential address by Mr. W. Reavell. 6 p.m.

Institute of Metals: Sheffield Local Section.—Applied Science Department of the University, St. George's-square, Sheffield. Sorby Lecture, by Professor H. C. H. Carpenter. 7.30 p.m.

Junior Institution of Engineers.—39, Victoria-street, London, S.W. 1. Lecturette, "Boiler Accidents," by Mr. R. H. Kenyon. 7.30 p.m.

Manchester Association of Engineers.—The Engineers' Club, Manchester. Presidential address, by Sir B. Longbottom. 7.15 p.m.

FRIDAY TO SATURDAY, OCTOBER 22ND TO 30TH.

Motor Show.—At Olympia, London, W. 6. 10 a.m. each day.

SATURDAY, OCTOBER 23RD.

Institution of Municipal and County Engineers.—East Midland District meeting at Nottingham. 10.15 a.m.

MONDAY TO WEDNESDAY, OCTOBER 25TH TO 27TH.

British Commercial Gas Association.—Fifteenth annual Conference at Newcastle-upon-Tyne.

MONDAY, OCTOBER 25TH.

Institution of Mechanical Engineers.—Storey's-gate, Westminster, London, S.W. 1. Graduates' Section meeting. "An Investigation into the Cylinder Losses of Locomotive Engines," by Mr. E. L. Diamond. 7 p.m.

TUESDAY, OCTOBER 26TH.

Institution of Civil Engineers.—Great George-street, Westminster, London, S.W. 1. James Forrest Lecture. "Radio Communications," by Senator G. Marconi. 6 p.m.

WEDNESDAY, OCTOBER 27TH.

Institution of Automobile Engineers: North of England Centre.—The Engineers' Club, Albert-square, Manchester. Presidential address, "The Debt of the Community to the Automobile," by Mr. H. Kerr Thomas. 7 p.m.

Institution of Engineers-in-Charge.—General Electric Company's Office, Magnet House, Kingsway, London, W.C. 2. Paper, "Small Refrigeration Plants and their Application," by Mr. N. E. Barber. 7.30 p.m.

THURSDAY, OCTOBER 28TH.

Institute of Metals: Birmingham Local Section.—The Engineers' Club, Waterloo-street, Birmingham. Paper, "Fatigue," by Dr. D. Hanson. 7 p.m.

Institution of Automobile Engineers.—Watergate House, Adelphi, London, W.C. 2. London Graduates' meeting. Discussion on the Motor Show. 7.30 p.m.

Institution of Automobile Engineers.—Training School, Vauxhall Motors, Ltd., Luton. Luton Graduates' meeting. Paper, "Hydraulic Transmission as Applied to Automobiles," by Mr. W. S. Bull. 7.30 p.m.

Institution of Locomotive Engineers.—The Engineers' Club, Coventry-street, London, W. 1. Paper, "Braking of Trains on Electrically-operated Railways," by Mr. R. C. Bond. 7 p.m.

FRIDAY, OCTOBER 29TH.

Society of Technical Engineers.—Queen's Hotel, Birmingham. Address on "The Engineers Bill," by Mr. R. Hazleton. 7.30 p.m.

SATURDAY, OCTOBER 30TH.

Finsbury Technical College: Old Students' Association.—The Engineers' Club, Coventry-street, London, W. 1. Fifteenth Annual Dinner.

Institution of Municipal and County Engineers.—South Midland District Meeting at Aylesbury. 10 a.m.

FRIDAY, NOVEMBER 5TH.

Institution of Mechanical Engineers.—Storey's-gate, Westminster, London, S.W. 1. Thomas Hawksley Lecture, "Elasticity and Plasticity," by Professor E. G. Coker. 6 p.m.

The Institution of Civil Engineers: James Forrest Lecture.—It has now been arranged that the "James Forrest" lecture, which was intended to be given in May, but had to be postponed, will be delivered at the Institution on Tuesday, October 26th, at six o'clock. The lecture will be given by Senator G. Marconi, G.C.V.O., Hon. M. Inst. C.E., on the subject, "Radio Communications." Before the lecture, the Kelvin Medal for 1926, which has been awarded by the Kelvin Medal Committee to the Hon. Sir Charles A. Parsons, K.C.B., F.R.S., M. Inst. C.E., will be presented to him by Sir William Ellis, G.B.E., the President of the Institution.